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THE TREATMENT OF DISEASE

BY ELECTRIC CURRENTS

A HAND-BOOK OF

Plain Instructions for the General Practitioner

BY

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PREFACE.

GALVANIC, faradic, and static currents are important medical remedies which can only be prescribed by those who know how to use them. The treatment of disease by electric currents is an essential part of the practice of medicine. It has been my aim to make this treatise a plain hand-book of instruction in the medical uses of electricity. It is therefore free from electro-technics and terms which the general practitioner may not understand. Even in nosology I have avoided formal classifications of disease and have chosen descriptive terms of clinical significance rather than the system of the lecture room.

I have attempted to clear away many of the perplexities of the subject. The central facts of electro-physics and physiology are condensed into a few chapters while the major portion of this treatise deals with therapeutics alone. I have aimed to make every chapter as instructive as a clinic. As the name of a disease does not always signify the pathological state or stage of a progressive lesion, I have described the electrical treatment for a variety of different clinical conditions in important diseases so that the physician can turn to these pages for practical help in the treatment of his own cases. The reader will find explicit indications for the selection of current, choice of poles, application of electrodes, regulation of dose, and duration and frequency of treatment, throughout the therapeutic range of galvanic, faradic, and static currents.

The X-ray methods of employing the static apparatus are described in the author's Manual of Static Electricity in X-Ray and Therapeutic Uses, and are therefore omitted from this volume.

S. H. MONELL.

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THE TREATMENT OF DISEASES BY ELECTRIC CURRENTS.

CHAPTER I.

THE STATUS OF MODERN ELECTRO-THERAPEUTICS.

THIS is an age of both medical and electric progress. The desire is universal to know something of an agent which has revolutionized the lighting industry, the transmission of motor power, and street railway traction, and which is destined to enter still more largely than it now does into the commercial, domestic, and medical work of the future. In most electrical lines the days of experiment are over, and the facts are now so well established that the generation of electricity is as closely standardized as are steam engines or bolts or screws. There is no need of attempting to explain what electricity really is, for the laws which govern its use are as well defined and as thoroughly understood as those which apply to light, heat, or air.

No intelligent person is now expected to remain ignorant of the fundamental laws of electricity, and its chief practical applications in the arts and sciences. A chair of electrical engineering is established in all our universities, colleges, and schools of higher education, and it is now only a question of time when every medical course will provide instruction in electro-therapeutics.

There have long been two prevalent errors in regard to medical electricity. Some assume that it is yet in its "infancy," while others, with equal ignorance of the facts, say that "electricity is a science which is changing so continually

and making such rapid advances" that the knowledge of to-day will be obsolete to-morrow, ergo—it is premature for physicians to learn anything about it. These views would fit the therapeutics of massage, of cod-liver oil, Dover's powder, Fowler's solution, tincture of iron, iodide of potassium, Magendie's solution, mistura rhei et sodii, calomel and quinina sulphate, vini ipecac, nux vomica, and aconite as well as they fit the therapeutics of the various electric currents.

The three great currents now employed in medicine date from about the years 1832, 1800, and 1750. They have been weighed in the clinical balance, tested in laboratories, and proved by experience. Ninety per cent. of the practical uses of these currents have been established so conclusively, that if the general profession should suddenly advance up to the world's sifted knowledge of electro-physiology and therapeutics, the benefit to patients would represent the greatest progress in clinical medicine this generation has ever seen. Scores of able and scientific men have carefully developed the great study of electricity in its relation to disease.

New chemical drugs multiply so rapidly that it is impossible to remember the names from month to month, but the very greatest remedies remain with us unchanged in value, and do not undergo any "rapid advance," either in their curative properties, dosage, or methods of administration.

Among these time-tried and priceless remedies electricity has won a foremost place. As it is popularly regarded as still in its infancy, and still undergoing rapid advances in methods of application, let us consider what "advances" are actually taking place.

The basis of scientific development in the application of electricity to both industrial and medical uses is Ohm's law. This was published in 1827, and for seventy years has been the bulwark of investigators, who rely upon it in all mathematical calculations. It does not change with time and is a fixed law, which, like the law of gravity, can undergo no "rapid advance" or be impaired by "new discoveries."

The uses of medical electricity to-day involve certain methods and apparatus. "Rapid advances," if any are taking place, must effect these in a revolutionary manner. Familiarity with the history of the subject summarizes the prominent facts as follows:

STATIC ELECTRICITY was introduced to medicine about the year 1750. Almost every disease now successfully treated by this agent was successfully treated by it a century ago by the pioneer investigators who originated the apparatus and most of the clinical methods. The methods and electrodes then employed are still practically the same, with the exception of Leyden jar currents, which date from 1881—sixteen years ago.

Static apparatus reached nearly its improved form in 1885, and the latest machine has now been in the market since 1893. The last therapeutic method to be introduced was described by the present author in 1893.

The physiological actions of static currents were demonstrated and reported by scientific observers in 1775–1790, and again in 1840–50. Modern researches between the years 1885 and 1895 confirmed the accuracy of the previously published facts on this subject and added little to them.

Static electro-therapeutics in expert hands have been substantially matured. "Rapid advances" or further "discoveries" can hardly impair or alter the ascertained value of the various forms of current derived from the Holtz machine. The great improvement which has been going on during the past three years, and which has received a wonderful impetus through Roentgen's discovery of X-rays, consists chiefly in the spread of knowledge among individuals who were before unfamiliar with this branch of medicine. This is an important advance, but it does not alter the existing facts; it simply disseminates them among a greater number of people. The sound development of the decade just closed has placed static electro-therapeutics upon a firm and reliable basis.

GALVANIC ELECTRICITY.—This current may be considered to practically date from the year 1800. External applications

of galvanic medical currents are either local or general. General applications are confined to a single method (central galvanization), which was described many years ago and which retains the form of its long since established technique.

Localized external applications of the galvanic current have received ninety-seven years of gradual clinical development, and are as well determined at the present day as the dosage and clinical methods of employing ipecac. It is impossible to point out any important novelty or new method of application which has been introduced to galvanic technique within the past two years, and we are now in possession of reliable methods which procure the most useful therapeutic effects of this current. If all physicians understood the best methods now known, there would be no further mention of *rapid advances.*

The chief of special galvanic methods are (1) Apostoli's methods; (2) Metallic electrolysis; (3) Hydro-electric methods.

The gynecological methods of Apostoli were matured by himself and others during the decade 1885–1895, and since then have remained practically unimprovable. Metallic electrolysis received large experimental attention prior to 1894, by which time its therapeutic uses were well established, and the possibilities of further rapid advances in this valuable method are about equal to the same prospect with regard to the cautery, or carbolic acid, or Dover's powder, or tincture of iodine.

Cataphoric medication was first demonstrated many years ago and received its final development between the years 1886 and 1891. As operators have repeatedly proved that all soluble remedies can be conveyed into the tissues from surface electrodes there is little room for further "advance" in the principle of cataphoresis, for the principle is the same whether the drug employed be new or old.

In hydro-electric applications special electrodes and improved methods of employing older measures were introduced from

1888 to 1894, and these are now substantially settled in their appropriate place in electro-therapeutic procedures.

Galvano-puncture and galvano-cautery have been employed for so many years, and methods and instruments have been so conclusively established, that to expect further "rapid improvement" of a revolutionary nature would be like expecting rapid advances in forceps, probes, and scalpels.

It may reasonably be assumed, therefore, that galvanic electro-therapeutic methods are as well matured in the hands of educated experts as are the methods of ordinary surgery or the technique of vaccination. Galvanic apparatus, meters, rheostats, electrodes, etc., of superior construction and quality may certainly be purchased to-day with secure confidence that no development in sight will make them obsolete. The market is full of inferior goods, it is true, and those who make genuinely scientific electro-medical apparatus are few in number, but physicians should prefer to deal only with makers of approved experience and reliability.

Faradic Electro-therapeutics.—The induction coil was the discovery of Faraday—a master-mind and a master electrician—in 1831–32, and it has been evolved to approximate perfection by the genius of electricians who have since builded on Faraday's work. Medical coils of high-efficiency are procurable to-day and have their period of experimental advancement several years behind them.

External applications of Faradic currents may be local or general. General faradization was perfected, in technique, a score of years ago, and it has since witnessed no rapid advance for the sufficient reason that the established technique is complete.

Localizing methods of employing induction-coil currents have been sifted by the experience of hundreds of operators for sixty-five years and have slowly matured with the gradual development of scientific apparatus. The limitations of current action do not allow of "continuous changes" in methods. The best methods remain as fixed as the methods of massage.

The greatest innovations in modern "faradism" were the evolution of the high tension medical induction coil apparatus evolved from 1888 to 1895, and Apostoli's bi-polar method which was suggested by Tripier in 1860 and perfected more than four years ago. So-called "rapid advances" in this field relate chiefly to the progress of the individual physician from personal inexperience to practical skill in what has already been long established and known to others.

The physiological and therapeutic properties of faradic electricity were clearly defined (except as to most rapid rates of interruption) almost as soon as discovered 65 years ago. It was at once accorded a place in medicine and a popularity which time has vindicated. In every country it was investigated by scientific men, but the labors of Duchenne over-top his contemporaries.

"This accurate observer and careful experimenter, by his thorough electro-physiological and neuro-pathological researches, at once firmly established the induced current on a scientific basis, and we may well," says the historian, "speak of this great apostle of faradism as the founder of modern electro-therapeutics. He not alone discovered the physiological and therapeutic properties of induction currents but developed and perfected them so that but little has been added since his day. He placed faradism, by his classical work from 1847 to 1855, almost where it now stands—'*far ahead of the present general knowledge.*' He discovered the motor points of muscles, he made the distinction between primary and secondary coils, he recognized the difference between coils of heavy and of fine wire, and he taught the principle of concentrating the action of the current upon the locality which he sought to influence. "He who simply follows the course of Duchenne's investigations (finished a quarter of a century ago) will review the more important physical, physiological, and pathological features of faradic electricity."

A survey of the medical uses of galvanic, faradic, and static electricity (extensive and valuable as they now are), demonstrates that future progress beyond the best present results of leading and original workers, must be in minor details only, and that the chief *principles* of action and application—electro-

physiology and electro-therapeutics—are as nearly settled and confirmed by clinical experience as anything in drug physiology and therapeutics.

Progress there will be, but the practitioner who lives in the present generation need not wait for the coming of a new Faraday before commencing the A. B. C. of a branch of medicine which has already grown beyond the powers of any one man to employ its entire resources. The treatment of disease by electric currents is a profound study which may profitably engage the attention of every physician who is interested in the welfare of his patients, whether he desires to make personal use of the resources of electro-therapeutics, or to merely qualify himself to give a consultant's advice.

CHAPTER II.

ELECTRIC CURRENTS AS MEDICAL REMEDIES.

I LEFT a medical college to engage in the practice of medicine, completely ignorant of the real therapeutic properties of electric currents, and somewhat prejudiced against electricity by the teachings of my *alma mater*, whose faculty held it in light esteem. Both myself and fellow-students measured the merits of the agent by the apparatus commonly exhibited, and it was impossible to set a high value upon a remedy that took its origin from tawdry boxes costing three, five, or even ten dollars.

We did not then know one current or one battery from another, but viewed them in the same light, and regarded electricity as almost exclusively a quack affair, unworthy of an educated physician's attention. I therefore often advised patients against electricity during my first year in general practice, and supported my advice by quotations from authoritative teachers.

At that time I had never seen any apparatus except family batteries, and had not become aware as yet that any informing treatise upon the subject was in print. The fact that electrotherapeutics was an important and scientifically developed branch of medical practice, was not even suspected by me during my period of undergraduate instruction, nor for a full year thereafter. The various subdivisions of important medical currents and the different principles of galvanic and faradic apparatus were not only undreamt of when I advised patients that " electricity would do them no good," but I did not then know that a therapeutic static machine existed. My astonishment when informed for the first time that such an affair was

a therapeutic appliance, actually employed in medicine, was like that of the Indian who first saw a locomotive.

Physiological effects were equally a *terra incognita*, and electrodes were all wooden handles terminating in a small flat sponge.

About a year afterward, accident gave me a glimpse into the clinical capabilities of electricity. I saw a case of sciatica for which drugs had been prescribed in vain, improve and get well under the use of a coil current, and a desire to know more of such a remedy gradually developed.

The first step in rational comprehension of the subject was my awakening to the fact that electricity was a generic word like heat, medicine, food, exercise; and was not dosable as a remedy until prescribed in definite character and terms. It was next plain that an intelligent prescription of this remedial agent must select definitely the particular current, polarity, dose, application of electrodes, method, duration and frequency of treatment, as specifically as in drug medication; and in order to do this the different electrical currents must be studied as medicinal agents.

Up to this point galvanic, faradic, primary, and secondary currents were only separated in my mind by the notion that one was *stronger* than the other, and their real differences were not comprehended until the utter worthlessness of the crude toy known as the "family battery" was revealed to me by later experience. Upon pursuing an intelligent plan of study I discovered that modern medical electricity is in fact a compound remedy, possessing many-sided actions and therapeutic properties derived from different modifying devices in scientifically constructed apparatus, which alter its character and quality in various degrees, so that it performs many different kinds of work and partakes of the nature of different remedies.

I ascertained further that by varying the form, character, quality, method, time, frequency, and management of the administration, and by employing proper instruments, this

remedial agent could be caused to produce the effects upon the general nervous system and nutrition, of either a sedative or tonic or alterative or stimulating remedy; or could, by special or local applications, be so modified and employed as to exert physiological actions which could be classified with the effects of principle drugs, such as the motor-excitants, the tonics, sedatives, alteratives, nerve foods, diuretics, anti-spasmodics, anti-pain remedies, counter-irritants, restorative agents, and all aids to functional processes; besides the chemical, electrolytic, caustic, and cautery effects of the direct galvanic current applied with bare metal electrodes.

Coincident with this surprising knowledge came the revelation that there are now three chief sources of electro-medical currents: (1) The chemical cell, which generates the direct galvanic current of low voltage, large amperage and marked chemical action; (2) The induction coils which interrupt the constant flow of the direct current, raise the voltage, reduce the amperage and create greater mechanical force with diminished chemical action; (3) The imposing static apparatus from which we derive currents of still greater voltage and diminished volume.

A complete galvanic apparatus requires a large number of cells (50 or 60), together with controlling and measuring instruments for regulating the dose; a coil apparatus (with 4 or 6 cells only) must contain an assortment of coils of various lengths and sizes of wire, aggregating nearly eight thousand feet in various combinations; and a therapeutic Holtz machine should contain six or eight revolving glass plates of not less than twenty-six or thirty inches in diameter.

From these three different sources the great medical currents take their origin, and the physiological actions upon which the curative properties of electricity depend, cannot be demonstrated in their entirety without employing complete and high-efficiency apparatus.

When these unalterable facts became clear to me, the cheap faradic box, sold by many dealers in druggists' sundries, was

recognized as the most insidious enemy the cause of scientific electro-therapeutics has ever known. It was seen to be a blight upon progress wherever it deceives and prejudices the physician, because it has no merit to redeem the gross quackishness of its nature, and is as deficient in true therapeutic properties as it is cheap in price.

Those who appraise the clinical value of medical electricity by the standard of pocket coils are as wide of the mark as he who would estimate the capacity of an ocean steamship by the toy boat which a boy sails on a pond. No other influence opposes so great a barrier to adequate professional appreciation of one of our very greatest curative agents as the countless thousands of trashy coil batteries sold for popular use, and which are but a mockery in the hands of the ignorant.

It took me some time to find this truth out, for I bought such a battery at the beginning and was inclined to be proud of it. They are, however, unfit for medical purposes regardless of greater or less cost, yet many cling (I long did myself) to a crude and utterly worthless faradic box, as if it was the fountain-head of the healing art. Once rid, however, of this retarding idea and in possession of properly constructed and high-efficiency electrical apparatus, the true merits of this valuable agent rapidly become clear. They assert themselves in daily clinical experience, and no longer need an advocate, for they become apparent to all observers. *Conservative writers, in fact, do not now make any claims as to the merits and physiological action of galvanic, faradic, and static currents. They simply record approved demonstrations, and the entire medical world may verify the same.*

Prior to 1880 periodical waves of interest in electro-therapeutics passed over the medical profession. The *rise* of such waves was due in each case to the genius of special workers, who devised exceptional apparatus and improved upon preceding methods. Interest in reports of such men induced many others to seek for similar results in their own practice, and the wave of popularity rose high because of the instinctive

belief, in the majority of mankind, that this wonderful agent must of necessity be valuable in medicine.

The *decline* of the wave of general interest was due to the fact that the exceptional apparatus and skill of leading workers were not duplicated in the hands of hundreds of other practitioners who attempted to produce therapeutic results with non-therapeutic instruments, and who signally failed.

Some employed a crude faradic battery in the belief that they were obtaining from it both galvanic and faradic currents, and I remember seeing an announcement of one physician who also derived static currents from the same source.

While a large number of cheap electrical devices were made and sold, there was little appreciation of quality and the cheapest was considered "good enough," while the best in general use was exceedingly poor. When improvements were devised there was neither duplicate supply nor demand for them. In 1860 Tripier had made for himself a faradic apparatus with a series of coils superior to anything in use at the time, or for the next twenty-five years. He also devised bipolar electrodes and laid the foundations for the future work of Apostoli, but in his own day his efforts passed almost unnoticed.

This state of affairs is now a thing of the past. The conquering march of industrial electricity has changed the whole aspect of the science. Prior to the introduction of the electric light and the electric motor, the laws and principles which control the actions of electric currents were practically all discovered and established, but mechanical applications were experimental and few.

When mechanical applications became commercial, and reached, as they did during the past ten years, an investment of nearly a billion dollars in this country alone, there was no further room for any backward step in the development of the uses of electricity. A true appreciation of quality in an electromedical apparatus is taking the place of the old idea that any kind of a contrivance will do.

The law of supply and demand is taking practical effect. Manufacturers are providing, or will provide to order, perfected instruments which leave little to be desired. The practitioner now recognizes that good work requires good tools, as well as various tools, and that he cannot substitute a coil for a cell current or a static machine, but must refer each character of therapeutic work to the instrument which will properly accomplish it.

There will never again be a down grade to the interest in scientific electro-therapeutics, but on the contrary there will be a gradual extension, throughout a larger and larger portion of the medical profession, of the knowledge that has been confined to a few, until, at length, the subject is adequately taught in all medical colleges, and every graduate becomes familiar with the common principles of this great branch of medicine.

CHAPTER III.

PRACTICAL POINTS IN GENERAL ELECTRO-PHYSICS.

Definition of chief terms. Resistance and its management. Magnetism. Primary and secondary currents. Definition of "tolerance." Electrodes. Special electrodes for galvanic work. Faradic electrodes. Static electrodes. To reduce resistance of galvanic electrodes. "Active" and "indifferent" electrodes. How to test the polarity of each current. Therapeutic polarity. The choice of galvanic poles in treatment. Indications for positive. Indications for negative. The choice of faradic poles. Choice of static poles. Practical operative methods. Preference for simplicity in technique. Length of *seances*.

THIS chapter is designed to be instructive to the physician who cannot spare time for either a clinic course or for much reading, and who wants the essential facts in a nutshell.

Before we can successfully treat diseased tissues with electric currents there are two necessary steps of preparation. The first is a knowledge of how to use electrical apparatus, and the second is an understanding of the action of each different current upon and within living tissues.

These branches of study are separately designated electro-physics and electro-physiology, and it is said that no one can be a master in electro-therapeutics unless he is also a master in these. There is nothing difficult about this, for it simply means dexterity in the use of tools and a knowledge of the work each will do. No one can be a good carpenter unless he knows how to use his saw, hammer, plane, chisel, measuring instruments, and other tools of his trade, and equally of course, no one can be a practical electro-therapeutist unless he is prepared to manage his apparatus. Practice teaches this simple dexterity after the principles are understood, and in this chapter I shall set down some of the chief general points to understand.

A working alphabet of the subject of medical electricity is first obtained by defining the ordinary terms in most common use. The definitions which follow should be carefully familiarized.

AMPERE.—The practical unit of galvanic current strength or rate of flow. It represents too large a unit for medical dosage and is therefore divided by one thousand, to establish the therapeutic unit, the milliampere.

AMPERAGE.—The expression of current volume or rate of flow. Galvanic currents possess large amperage, while faradic and static currents have very small amperage, in proportion to their respective E. M. F.

ANODE.—A synonym for the positive pole or electrode.

CATHODE.—A synonym for the negative pole or electrode.

CIRCUIT.—The entire pathway around which a flow of current is established by continuous conductors.

ELECTROLYTE.—An organic substance or fluid which can be caused to undergo chemical decomposition by the passage of a sufficient galvanic current through it. The human body is a complex electrolyte.

ELECTROLYSIS.—A separation of compounds into elements by the action of an electrical current of sufficient amperage.

ELECTRO-MOTIVE-FORCE.—The voltage of an electric current. Pressure and potential are often used to signify nearly the same thing.

ELEMENTS OF A CELL.—The plates of zinc and carbon.

EXCITANT FLUID.—The chemical fluid in which the elements of the cell are immersed. When the elements are acted upon by the solution, an electric current is generated.

FARADIC ELECTRICITY.—A general term for induction coil currents. It is inexact, because it does not distinguish between currents from different coils with different rates of interruption and different qualities.

FARADIZATION.—A term signifying the application of some form of faradic current.

GALVANIC ELECTRICITY.—A general term for direct currents from primary chemical cells.

INDUCTION COILS.—The mechanical devices which transform the direct galvanic current into induced or faradic currents.

LABILE APPLICATION.—A term signifying that one or both of the electrodes is kept moving over a part during the treatment of a patient.

MILLIAMMETER.—The calibrated galvanometer used to indicate the number of milliamperes employed in treatment. It operates with continuous galvanic currents only. It cannot measure the interrupted galvanic or induction coil or static currents.

MILLIAMPERE.—The medical unit of galvanic current dosage. The one-thousandth part of one ampere.

OHM.—The unit of electrical resistance. It is equal to the resistance of one thousand feet of No. 10 pure copper wire at a temperature of seventy-five degrees F.

OHM'S LAW.—"The amperage of a current is equal to its voltage divided by the resistance of the circuit." In medical usage the quotient is the net dose in milliamperes.

POTENTIAL AND PRESSURE.—Both signify nearly the same thing as the voltage of a current.

QUANTITY AND VOLUME.—Inexact synonyms for amperage.

RHEOPHORES.—The pair of conducting cords by which electrodes are connected to the battery terminals. Generally called "cords."

RHEOTOME.—The device upon the switchboard which interrupts current flow.

RHEOSTAT.—A current controller operating by "resistance."

SERIES.—Connecting alternately the zincs and carbons of a series of cells. All batteries except *cautery* are connected in series.

STABILE APPLICATION.—The opposite of labile, and signifies that the electrode is kept still during treatment.

SHORT CIRCUIT.—A circuit which is entirely composed of metallic conductors.

SWITCHBOARD.—The part of the electrical apparatus which contains the devices for regulating the current.

TENSION.—A term closely related to voltage. High tension currents are induced currents with high (medical) voltage and very small amperage.

VOLT.—The unit of electro-motive-force.

VOLTAGE.—Refers to the E. M. F. of an electric current. Voltage is the pressure force behind the current flow. Galvanic currents average between one and one-half and two volts per cell. Primary induction coil currents have an E. M. F. of about ten volts per cell. Secondary coil currents multiply this in proportion to the increasing length, number of terms, and fineness of wire. The entire range of voltage afforded by an improved coil apparatus probably runs from zero up to about one thousand volts, while static currents possess a very much higher potential, estimated from 100,000 to 1,000,000, depending on the size and speed of the plates, dryness of room, etc.

There are three factors in medical electricity with which the physician must become as familiar as he is with the influence of dosage upon the administration of drugs.

1. *Electro-motive-force* depends upon the difference of potential at the two poles and furnishes to every electric current flow what the pressure of height does to a column of water with an out-flow at the base.

2. *Resistance* is the obstruction offered to the flow of current by the conducting materials which compose the circuit.

3. *Current* is the electricity flowing through a conducting circuit.

These three factors (Force, Resistance, and Current) must be considered in every application of electricity, for the current strength is obviously equal to the pressure divided by the resistance, and this is Ohm's law simply stated. It is the basis of exact measurement in electricity and was published by Dr.

G. S. Ohm, in 1827. It has stood the tests of time, and ranks with the laws of gravitation and of electric attraction and repulsion as a natural law to which there are no known exceptions.

It may often be presented at such length and with such a variety of algebraic formula as to bewilder the student of electro-therapeutics, but the simple understanding above given is a sufficient working basis.

With the exception of the milliammeter measurement of the current strength of a single medical current (the constant galvanic) no measure of E. M. F. or R. or C. S. is made in ordinary electro-therapeutic practice. The resistance of a patient, or of different tissues of the body, is sometimes measured with appropriate instruments as a matter of curiosity or for purposes of investigation, but in clinical practice the physician simply switches into circuit enough E. M. F. to furnish the desired C. S. over the R. of the patient regardless of whether the resistance is twenty, or two hundred, or two thousand ohms. No instrument has yet been invented which provides a measurement of the voltage and amperage of induction coil and static machine currents and the proper regulation of current strength is largely a matter of practical experience.

The meaning of the word Resistance is so clear that it needs no further definition, and in electrical writings its accepted meaning is unaltered. In electro-therapeutics we either wish to get rid of excessive resistance to the current flow or we employ it as a current controller or rheostat. We therefore manage resistance in one of two ways:

1. To secure in treatment the greatest possible part of the electric current generated in the battery cells we convey it to the patient through the best possible conductors—copper wires and well moistened or metallic electrodes. Poor conductors deliver less current at terminals because they impede the current flow. It is better therapeutics and economics to prevent waste of current by applying it through good conductors than

it is to purchase an excessive number of cells to offset the loss through bad conduction.

2. To regulate the dose when the initial current is greater than we wish to pass through the tissues we interpose a concentrated resistance (a rheostat or current controller) in a convenient place on the switchboard and then control and regulate the administration by using just enough of the interposed resistance to impede the excess of current strength and conduct only the desired amount.

The management of resistance in electro-therapeutics is practically accomplished by experience without exact measurements in ohms.

Magnetism.—As the current from an induction coil is related to the magnetic saturation of an iron core in the primary coil we must obtain a general idea of magnetism and how it acts.

Every magnet has two opposite poles. If it is cut in two each piece will be found also to have a north and south pole, one of which will attract the opposite pole of any other magnet. An electric current passing through certain metals sets up magnetic action, and conversely magnetism produces an electro-motive-force.

When a number of turns of copper wire are spirally wound around a few soft iron rods they become magnetized during the flow of a continuous current through the surrounding wire and lose their magnetism when the current stops. The amount of magnetism they acquire from the current is increased by increasing the amperage of the electricity. Two cells will therefore induce greater magnetic force than one, and four cells greater than two. Cells with large elements generate currents with larger amperage than cells with smaller elements, and consequently are more efficient in magnetizing the iron rods.

Every increase in the magnetic saturation of these iron rods increases their effect upon the resulting induction current.

The primary and secondary currents of induction coils are

created by the processes of induction which take place between the coils and the magnetized iron rods during the periodical activity of the primary cell current.

We become so familiar with the actuality of induction that it is sufficient to be able to practically employ induced currents as we desire without attempting to follow the speculations of the philosopher into the nature of inductive influence. Faraday made the discovery of induction, and in some way or other it now enters into almost every practical application of modern electricity with the exception of primary cell currents.

Primary and Secondary.—These words are familiarly associated with faradic batteries, and many suppose that *primary* means the galvanic current and that only the *secondary* refers to the faradic current. As educated and experienced physicians have informed me that they shared in this common misunderstanding we must correct this error at the start.

The word *primary* on a battery switch and in printed directions refers to the *first coil* of the induction device. The primary current is the first *induced* current of a faradic battery, The word *secondary* refers to the current from secondary induction coils which overlap the primary coil.

These two words may refer elsewhere to either primary or secondary *cells*, or primary and secondary *coils*. The primary cell is the chemical cell and source of the direct galvanic current. The primary coil is the coil which is wound upon the core of iron rods and produces the primary induced current of a faradic apparatus. The secondary cell is less familiar to physicians than the primary cell and is now generally called a storage battery. It does not generate a current itself, but requires to be charged from some primary supply. It is never employed in a faradic battery. Secondary coils are the longer and major coils of the faradic apparatus, and the currents which we obtain from them result from the second induction process which takes place between them and the primary coil. Coils are really transformers of the proportions of voltage and amperage in electric currents which pass through them.

The primary coil current is an altogether different matter from the primary cell current, for the coil has acted upon the direct current of low voltage and large amperage and *induced* from it a current with three different characteristics. It is intermittent instead of continuous, has a high voltage and exceedingly small amperage. These characteristics, and especially their increased E. M. F., give to faradic currents their greater power to pass through resistances; and because amperage is now so attenuated in volume, and because chemical activity is still further diminished by interruptions, the faradic type of current from any form of induction coil, either primary or secondary, fine or coarse, long, medium, or short, performs no electrolytic or cautery work. It is wholly inadequate for such purposes. Its uses are rather electro-mechanical, for it is nearly all force. The primary coil in the best apparatus now made is chiefly a "step up transformer" between the primary cell current of low voltage and large amperage and a variety of secondary induction coil which provide us with secondary induction currents with marked additions to their voltage and mechanical properties, and from which chemical action is almost completely obliterated.

As the E. M. F. ascends through the "step up" processes the ordinary resistances of the human body become insignificant to the increased penetrating force of secondary coil currents, and on this account we require only a few cells (1, 2, 4, or 6) to secure our therapeutic dosage. This explains why faradic batteries have so few cells instead of the large number usual in galvanic apparatus. The qualities of faradic currents of high therapeutic efficiency are not wholly dependent upon the size, character, or number of the cells employed, but are the product of refinements in the construction of the separate coils and interrupters which control the factors of E. M. F. amperage, and quality.

The advantages secured by altering the chemical current through inductive transformers will appear in our study of electro-physiology. They are valuable advantages, and since

they have been secured with improved apparatus the range of farado-therapeutics has been extraordinarily increased, and earlier types of coil batteries must be discarded by all who attempt to follow the march of progress.

The physician whose acquaintance with electricity is limited to a non-therapeutic "faradic battery," may ask why it is that different currents can affect the tissues differently. This is easily made clear by the same explanation which applies to water and air.

Air and water act in one way when large volumes are nearly at rest, and in remarkably different ways when set in motion. These secondary effects are governed largely by the size and rate of the moving matter. The differences in the work performed by air supplying oxygen to the lungs, driving the sails of a ship, forcing a blast furnace, imparting its cold or heat to other bodies, furnishing pneumatic pressure in mechanics; or of water floating a navy in a broad harbor, driving, in a narrow torrent, the wheels of a mill, descending in gentle showers upon a growing crop, putting out a fire, quenching thirst, and serving the domestic and medical purposes of mankind as either water, ice, or steam have their analogies in the different kinds of work which we can cause electric currents to perform, by setting them in motion in different quantities and different rates under different conditions, and with the aid of different mechanical helps.

If we wish to develop predominantly the actions which most resemble those of mechanical forces we raise the voltage of a current upon the same principle that a rapid rate is given to a stream of water to produce horse-power for mechanical purposes. If we wish to develop the dynamic properties which are essentially inherent in electricity we use it in greater volume (amperage) and reduce the voltage so that mechanical action is subordinate.

In order to avoid the trouble of continually shifting the relations between voltage and amperage in a single source of electric current, we find it much more convenient to employ

separate apparatus which give us the altered types of current which experience has shown to be most useful. These appliances furnish us still further means of regulating the dynamic and mechanical activities of each given current, so that having ascertained the entire scope of action of electricity at the present stage of the world's knowledge, we may definitely select the exact current to perform any part of the work which it is known that electricity will do.

Before any physician can treat disease with electric currents he must know how to produce the effects of each current.

Definition of Tolerance.—In order to obtain a regulation of dosage, in many cases in which no measuring instrument can guide us, we depend upon an educated acquaintance with what is briefly called *tolerance of the tissues*. The operator becomes as familiar with the sensory and motor effects of the various currents upon normal and pathological tissues, as the fingers of the gynecologist become trained in bimanual examinations, and as the ear becomes trained to the language of the stethoscope.

It is difficult to put the full sense of the meaning of this term into words, but we qualify tolerance into different degrees, such as mild, comfortable, and maximum.

When an induction coil current is at the point of *mild* tolerance it will produce very gentle muscular and sensory effects. When it is at the point of *comfortable* tolerance it will produce more vigorous effects, which combine energy with comfort and do not produce either pain or fatigue. When the *maximum* tolerance is reached, we mean that the patient is on the verge of being taxed to endure the action of the current, no matter what its effects may be. The maximum tolerance may sustain a short application when some special effect is desired, but long applications of induction coil currents are rarely pushed to the point of causing pain and fatigue.

When the galvanic current is applied for effects of a general nature rather than of limited electrolytic action, we are often controlled in the regulation of dose by the *tolerance*

of the tissues instead of the reading of the meter. This is especially true in acute conditions associated with sensitiveness and inflammation. In these cases a current is kept within the limit of *comfortable* tolerance when it produces perhaps a comfortable warmth or slight tingling, or pricking, but no sensation which annoys or aggravates. Usually this tolerance inereases steadily during the application, and a current which is maintained at the same number of mil. throughout a sitting may cease to be felt at all before the sitting is ended.

When *maximum* tolerance is the guide to the limit of current strength it is the tolerance to the active electrode which is always meant. If this electrode is within the vagina or uterus, we pay no attention to the tolerance at the external electrode, except to increase the area of contact if the current becomes uncomfortable to the skin. The essential tolerance is that within the pelvic tissues, and any sign of pain or discomfort at the internal electrode during any form of galvanic treatment should always be heeded by the operator and the current reduced.

The term has little or no reference to static applications.

Electrodes.—Electrode is derived from two Greek words which signify an electric *way*. The definition given in the classical Century Dictionary is as follows: "A pole of the current from an electric battery or machine which is in use in effecting electrolysis; applied generally to the two ends of an open electric circuit. The positive pole is termed the *anode* and the negative pole the *cathode*."

This gives no hint of the real character and purposes of medical electrodes, and as faradic and static currents do not "effect electrolysis" the definition would leave them out of the account altogether. When we see the greatest Lexicon in the English language presenting a mediæval crudity as an up-to-date definition of one of the most obvious words connected with the subject of electricity, and find in many new works upon neurology, materia medica, therapeutics, and the practice of medicine in general, not only lingering traces of

the "Darkest Africa" era of electrical science, but almost a total disregard of its great modern development, we can regret, but we cannot *wonder* that the rank and file of the medical profession underestimate the value of electro-therapeutics.

Without a variety of suitable electrodes the therapeutic effects of galvanic, faradic, and static currents are as impossible as would be surgical results without cutting, dissecting, and suturing instruments. With galvanic and faradic currents both electrodes must be placed in contact with opposite portions of the tissues through which the current passes. With platform methods of employing static currents the patient becomes the terminus of one electrode, while the other is employed as a means of localizing and altering the rate of current discharge without actual contact with the patient. No influence upon *rate of change* is exerted by galvanic and faradic electrodes. The dose regulation with these currents is accomplished with complete independence of such manipulation as enters into the uses of static electrodes.

All electrodes require a conducting surface and attachment to a conductor. With galvanic, faradic, and Leyden-jar currents the conductors are attached to the terminals of the source of current. Static electrodes are grounded to the earth.

Galvanic Electrodes.—The subject of material for galvanic electrodes has now passed beyond the earlier experimental stages of wash leather, flannel, punk, gelatine-graphite, animal membranes, spongio-piline, and other coverings suggested during the past thirty years. The variety of electrodes required to cover the wide range of galvanic therapeutics will necessarily include almost every form and character of electrode that is made, except the few which are distinctly associated with static and faradic currents. Galvanic electrodes are either "protected" or bare metal. If protected, the covering material must be absorbent and possess the quality of retaining moisture, for the *material* does not conduct the current, but protects the skin from burning effects and holds the conducting solution in its meshes.

Fine sponge, if kept clean, may best be used upon small and convenient hand electrodes for minor galvanic applications with small currents, and if the application is labile no other covering is equal to the fine, soft sponge selected for this purpose by the best makers and lubricated with soap.

For extremely large dosage—a rare requirement in ordinary practice—the so-called Apostoli clay electrode, moistened with a hot water solution of bicarbonate of soda, renders the consideration of other materials unnecessary. A clay electrode in contact with the skin will conduct a larger amperage with less sense of irritation and pain to the patient than any other substance yet employed; but owing to the mussy nature of the material, it is used with reluctance and only when deemed necessary. The home-made clay electrode is unsatisfactory, but during the past year the Jerome Kidder Mfg. Co. have furnished hard-rubber molds lined with pure tin, which form shallow cups of assorted sizes, which may be filled with clay from a supply jar as occasion requires. Simply fill the mold, smooth off the surface, fit over it a piece of wet cheese-cloth to keep the clay in place and the electrode is ready for the patient. After treatment discard the cheese-cloth covering and the clay can be returned to the jar and used again and again. This set of cleanly electrodes does away with former objections.

For the great range of external and stabile applications, between the minor uses of sponge and the rare necessity for potters' clay, there is practically but one material to consider for all sizes and shapes of protected galvanic electrodes. This material is the thick, firm, white felt used upon piano keys. It is not expensive; is extremely durable, and when prepared for electrode use is thoroughly satisfactory. Manufacturers of electro-medical apparatus treat it to remove all grease and oil, and either keep in stock or will make to order a complete variety of pad electrodes of assorted sizes covered with this felt.

The occasional use of absorbent cotton as an impromptu covering for electrodes, to be freshly replaced at every treat-

ment, will naturally occur to all electro-therapeutists. It is indeed recommended by some for general service on the score of cleanliness but the resources of soap, hot water, and a little ammonia will certainly never fail to supply this great desideratum. The texture of absorbent cotton does not permit its use in labile applications, hence it is inferior in this respect to fine sponge. It packs tightly under pressure and does not retain moisture so well as felt, and hence is inferior to the latter material also.

These four materials, sponge, clay, felt, and cotton, are the most satisfactory in their separate places of any that are available in general practice. They possess the merits of simplicity, convenience, and little cost.

In addition to electrodes which consist of a metal base covered with some material which will absorb and retain water, we find it often useful to employ water itself as the medium of conducting contact. A water-bath electrode can be improvised by placing warm water in any jar or bowl which will contain the part to be treated, and sinking to the bottom of the water the tip of a conducting cord connected with the proper pole of the galvanic or faradic battery.

If a galvanic current is employed bicarbonate of soda, in proportion of a teaspoonful to a pint, should be added to the warm water. When the small joints of the hands or feet, the testicles or entire male genital organs, and parts of such irregularity of contour as to prevent contact with ordinary electrodes are to be subjected to the uniform action of any electrical current, the water-bath furnishes the only means of making contact at every point. It is a simple but indispensable device.

This brings us to consider bare metal electrodes not covered with any material to restrict cutaneous irritation. Such electrodes are employed in a field of specialized applications: rarely upon the external surface of the body, but chiefly upon mucous surfaces within the natural cavities, or inserted into tissues by needle puncture. Adaptability of size and shape

to the parts subjected to treatment therefore regulate the selection of these electrodes as well as the composition of particular metals. The negative pole of a continuous galvanic current does not attack metals, and it therefore makes no difference what metal is used either in a uterine sound, a puncture-needle, or any other bare electrode provided it is connected with the negative pole.

It must never for a moment be forgotten by the therapeutist, that the positive polar action of the galvanic current attacks and decomposes all metals of which electrodes are made, except platinum and gold. Gold electrodes are too expensive for common use and need hardly be considered. When the electrolytic action of the current alone is desired in any application with a bare metal electrode, the *negative* pole is used necessarily in all cases, except when platinum is employed with the positive. It must be remembered as an invariable rule that in all positive applications for purely galvanic electrolysis the electrode must be non-attackable by the current, or else one of two things will happen: the electrode itself will be injured by the corroding action of the current, or the tissues around it will be undesirably attacked by the metal decomposed from the electrode and driven into the tissues. To obviate these effects platinum is employed.

The variety of platinum electrodes required by the average practitioner is limited to puncture needles and perhaps two intra-uterine sounds. With these there is little need for substitute devices, but carbon electrodes and pure tin have occasional uses with medium and mild currents. Pure tin is not attacked by the positive current until the amperage reaches the intensity of strong currents, and as it is much cheaper than platinum we may employ it in a variety of sounds and tips.

Distinctly separate from the consideration of the above electrodes employed for the administration of either positive or negative galvanic currents is a third class of bare metal electrodes which combine galvanic with metallic electrolysis in

therapeutic action upon tissues. These are employed only with the positive pole of the current and add to the effects of positive galvanic electrolysis the supplementary action of metallic salts formed from the junction of the decomposing electrode ions with the ions of the electrolyzed tissues and driven into the tissues by cataphoresis. The soluble electrodes employed for metallic electrolysis are usually either copper, zinc, or silver. They are made in assorted sizes of tips, generally eight in a set, which screw upon a suitable insulated handle. Sets of sounds and needles are also made. Zinc electrodes may also be coated with mercury, and thus add zinc-amalgam to the varieties of electrodes. Iron, brass, and other metals have been experimentally tried, but we see that the minerals which possess the medical properties which prove valuable in their local actions when driven into the tissues by galvanic osmosis are for the most part those which are employed in other forms of topical applications for similar local actions. The sulphate of copper, the chloride of zinc, nitrate of silver, and bichloride of mercury have familiar uses in both concentrated and dilute forms in topical medicine, and similar but much more effective and deeper acting results are achieved by the oxy-chlorides of the same metals when they are not merely applied to the surface of a mucous membrane without absorption, but are driven below the surface and saturate the tissues and undergo absorption into the circulation.

A number of different names were given to this valuable method of supplementing enormously the action of galvanic currents upon catarrhal inflammatory processes of mucous membranes during the period of its development, but I shall adhere to the single term *metallic electrolysis* to designate administrations of this character.

Apart from the material of which any electrode is made it is obvious to the physician that it must, in some sensible sort of a way, conform itself to the size and shape of the parts to be treated and the dose of current strength which it serves to conduct. In ordinary external applications of galvanic cur-

rents with covered electrodes, the comfort of the patient will be best maintained if the area of the contact surface of the electrode reduces the current density below two milliamperes per square inch of contact. This relates to sedative or nutritional applications. It is *density* for a given area of contact and not the total of amperage that regulates the therapeutic effects and the comfort or discomfort of the application. An electrode 4 x 6 would reduce the density of 24 milliamperes to only one milliampere per square inch of contact, while 24 milliamperes condensed into a contact of 2 x 2 would increase the density to 6 mil. per square inch. A practical way to discover the difference in sensory effect is for the operator to demonstrate it upon his own cuticle.

When large currents are employed by Apostoli's methods, they cannot be agreeably managed unless the external electrode is large enough to keep the density down to tolerance, but in all cases, the preparation of the electrode and skin to serve as good conductors is not less important than the size of the contact.

When external applications are designed to affect a considerable area, an electrode large enough to cover the part is selected rather than any subdivision of the treatment by moving a smaller electrode from place to place. For instance, the entire spine can be affected at once by employing a felt-covered electrode about three inches wide and about eighteen inches long. Abdominal electrodes may be 6 x 8, or 8 x 12, or such other sizes as may be needed. If we bear in mind the effects which a given density per square inch of current action enables us to produce, we have only to increase the number of mil. to an equal proportion for the entire area of contact to obtain similar effects with any size of electrode.

In all external applications the operator must select a suitable electrode from among his general variety, but in applications which involve special methods the choice of a suitable electrode is much simpler than an unpractised reader might suppose, for many specialized methods have also specialized

electrodes made expressly for them, and very little perplexity of choice can exist after the physician arrives at even a "bowing acquaintance" with the tools of electro-therapy.

The therapeutic choice of faradic electrodes is exceedingly simple, for the variety is small and their different adaptabilities are obvious.

Faradic Electrodes.—The electrodes employed with faradic currents are of limited size and variety as compared with the extensive range of galvanic electrodes. The reason is obvious, for faradic currents act chiefly along the lines of mechanical force. A single experiment demonstrates that vibrations, impulses, or blows, from either mechanical instruments or interrupted electric currents are not effectively delivered by too broad a surface; hence large dispersing electrodes are never employed to cause muscular contractions, and the faradic electrode is usually small and compact. Metals are not actively affected by the current, and bare metal electrodes may be employed with either pole. Chemical differences of polarity may be ignored by the practitioner in the use of induction coil electrodes.

The choice of faradic electrodes is governed by convenience and the suitability of size and material to the manipulation of the operator more often than by other considerations. There is nothing in the action of faradic currents to prevent our using any electrode which we employ with the galvanic current, if it is convenient to do so.

The essential electrodes are all included among the varieties essential to a galvanic outfit with very few exceptions. One of these exceptions is the so-called faradic brush or scourge. This electrode is mentioned in almost all references to the treatment of local anæsthesias, but all who have static apparatus have better means of treatment, which are far more agreeable to the patient. Bipolar electrodes are the chief important varieties peculiar to the uses of faradic currents. The vaginal bipolar electrode is never employed with any other form of current, and may be regarded as the most typical

illustration of the highest therapeutic attainments of the modern development of faradism.

Static Electrodes.—The essential electrodes employed with platform methods are means of producing different degrees of local, convective or disruptive discharges. They are all pointed for convective discharges, and spherical for disruptive discharges. Pointed electrodes are brass, copper, or wood, and are single or multiple, fine or coarse. Ball electrodes are brass or wood, of larger or smaller sizes. The wooden electrodes have been furnished with machines for about one hundred and twenty-five years. They differ from metallic electrodes in being poorer conductors, and do not produce any effects which cannot be produced by the latter. They are, in fact, rarely employed.

The massage roller electrode acts upon the same principle as the brass ball, and produces short disruptive discharges which are called frictional sparks, when it is employed in the usual way. It can be also made to produce other effects. Static electrodes all require grounding in order to fulfill their functions.

The electrodes employed with Leyden-jar currents may be any that are employed with faradic currents, and need no separate consideration.

To Reduce Resistance of Electrodes.—We have noted that the pressure force of each galvanic primary cell is only about one and one-half volts at origin. The wires throughout the apparatus are all linear conductors. They deliver the current to the patient in the same form that it comes from the cells with the volume (amperage) reduced by the resistance of the circuit. A battery of forty cells, with an E. M. F. of one and five-tenths volts each, represents only sixty volts of electro-motive-force, and through a resistance of two thousand ohms would give only about three mil. of galvanic current. This would be many times too small for some therapeutic purposes and the satisfactory use of galvanic currents from an ordinary number of cells depends upon reducing the

resistance of the circuit by saturating the electrodes with a solution of high conductivity.

Plain water, either hot or cold, should never be used to

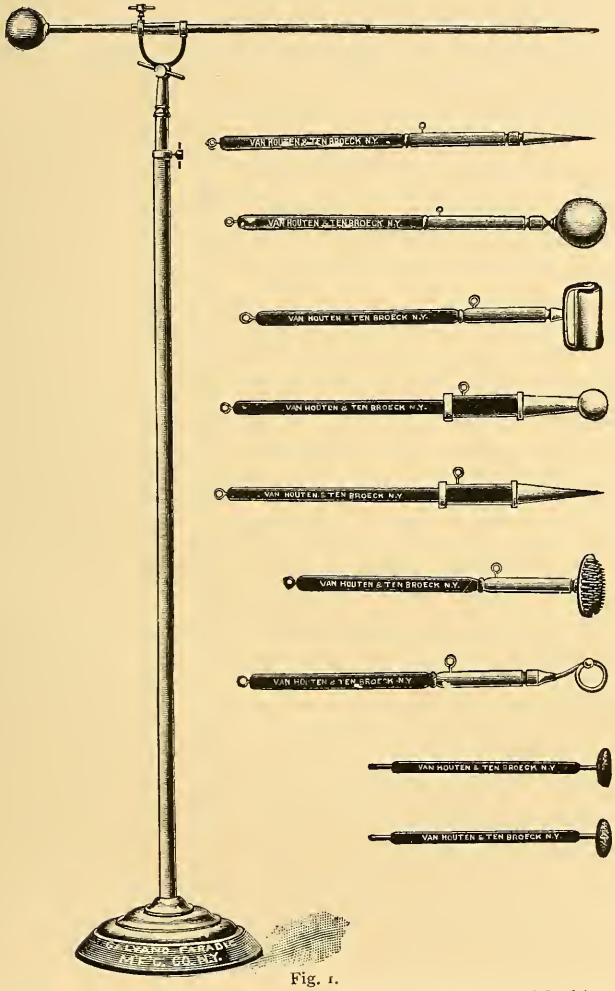


Fig. 1.

Set of Electrodes and Standard furnished with the Static Machine by the Manufacturers.

moisten electrodes for galvanic applications. Its resistance is so great that with the metallic tips of two conducting cords

placed about three inches apart in a shallow dish of water, the current between them is less than one mil. per cell. In clinically demonstrating the necessity of a good conductor it is usually found that the entire E. M. F. of twenty cells produces about twelve mil. in this experiment. Obviously the conducting properties of plain water must be improved, and the physician who knows how to do it rightly, has made a long start towards obtaining satisfactory dosage. It is a simple matter, although it is seldom explained in text books.

To about one pint of hot water in which felt, sponge, or other protected electrodes are to be moistened, add about one teaspoonful of bicarbonate of soda. This does not oxidize electrodes and is clean, bland, cheap, and convenient. One grain of it added to the water through which twenty cells produce only twelve mil. of current between terminals three inches apart, will instantly double the amperage. Two or three grains more will deliver to us four or five times the previous current from the same number of cells, and if we add half a dram of soda we can demonstrate five hundred mil. between the electrodes which in plain water demonstrated only about twelve mil.

When covered electrodes are applied to distant parts of the body, between which there may normally be too great resistance for the ordinary number of cells in a cabinet apparatus to produce the desired amperage, the value of knowing how to reduce the resistance by saturating the skin and the electrodes in a hot water solution of bicarbonate of soda is equal to the cost of any extra number of cells which would otherwise be required. The physician who has a cabinet of fifty cells need not buy one hundred and fifty, if he employs bicarbonate of soda in the above manner.

Faradic electrodes do not require to aid the current in getting through the resistance of the skin. All currents of considerable voltage will readily penetrate any resistances of the body and all covered electrodes for use with induction coil or Leyden jar currents may be moistened with plain water.

The "Active" and "Indifferent" Electrode.—In general electro-therapeutic writings the term "active electrode" is applied to the one at which the local polar action is chiefly sought. The "indifferent electrode" is the one required to complete the circuit without reference to any special local action.

Either of these terms may therefore belong to either polarity at different times, but as they are more or less perplexing to the general practitioner I shall not employ them in this book, but will state exactly where both positive and negative electrodes are to be applied in every case.

How to Test the Polarity of each Current.—To test galvanic poles: Place the metal tips of two conducting cords in a dish of plain water and connect them with the terminal posts of the galvanic switchboard. Start the current into action with any desired number of cells, five or ten. The metal tip which remains clear is positive. The tip at which bubbles of hydrogen gas appear is negative.

To test induction coil poles: The Geissler tube test is infallible. Connect the terminals of a small Geissler tube with the opposite poles of the induction coil apparatus. Switch the long coil, rapid vibrator, and four cells into circuit in a sufficiently darkened room. The lumen of the tube is at once filled with luminous radiations which appear like rolls of coin stood on edge.

With a low voltage they are faintly seen, and are of a light blue or violet tint. As the voltage increases they become brighter, and with the entire Kidder coil and four or five cells in action the tube produces a bright light. The distinct discs are in active agitation and lean slightly in the direction of the current flow from positive to negative. The bulb of the tube at the positive end is clear, and a small spark is given off from the internal electrode. The bulb of the tube which is filled with a glow discharge like mist, demonstrates the negative pole.

When the pole changer is reversed the discs lean in the opposite direction and the bulb which was clear becomes foggy.

In the absence of a Geissler tube make slight contact with the tips of the thumbs upon two ordinary electrodes of any kind. Switch one or two cells, the rapid vibrator and any one of the coils into circuit. Increase the current from zero until it is just felt. The electrode at which sensation is greatest is connected with the negative pole.

To test static polarity: Start the machine into action with the sliding poles near together so that a short spark stream passes between them, which is bright at one pole and violet-tinted at the other. The bright part of the stream identifies the positive pole.

Draw the poles apart until the spark-stream becomes a brush discharge intermingled with thin sparks. Draw the poles still further apart, and at the positive pole the stream will have a straight handle like a whisk broom. At the positive pole the spark stream will be visible after it has ceased at the negative pole. Connect the brass point electrode by the usual chain to the gas fixture and interpose the point in the spark stream at either sliding pole. If the spark stream stops, and is conducted away by the electrode instead of passing between the poles, it identifies the positive pole. If the spark stream continues to pass while the electrode is held against the ball to which the stream comes, this is the negative pole.

The practised operator distinguishes static polarity at a glance, or by ear, by a dozen denoting signs both by direct test and during every clinical application. It is always apparent to the expert which pole is connected with the platform, but to the beginner the above tests will demonstrate it conclusively.

Therapeutic Polarity.—The Choice of Galvanic Poles in Treatment.—The puzzling question to the student of electro-therapeutics, more puzzling perhaps than any other that confronts him, is the choice of poles in treatment. This perplexity will be greatly reduced by repeated study of electro-physiology. The practical physician who familiarizes himself with the demonstrated effects of each pole, and applies the same therapeutic principles which guide him in

the selection and dosage of different drugs, will have little trouble in deciding upon the polarity appropriate to any given case. The question of how much amperage is required to carry out any plan of galvanic treatment is also perplexing to many, but nearly all difficulties will be removed by close attention to a few important points.

Owing to the opposite nature of positive and negative polar actions upon muscular fibres, circulation, and the electro-tonic state of nerves, it is impossible to ignore polarity in the clinical applications of external electrodes. These effects largely control the question of the use of ascending or descending currents, for the direction of the current through human tissues is necessarily governed by the situation and relation of the electrodes. It is impossible to consider direction *per se* as anything separate from polar action. In probably seventy-five per cent. of therapeutic work with the galvanic current it will be found that rational regard to polarity, and indications for the situation of electrodes, will take the question of current direction out of debate.

In external administrations the positive galvanic electrode is applied in the upper, and the negative in the lower, course of the nerve and arterial distribution when it is desired to have the current act with and reinforce the processes of circulation, metabolism, and the cerebro-spinal and sympathetic nervous system, to obtain the calming effects of analectrotonos, to rest the brain and promote sleep, to vitalize and refresh the mind and body in states of profound depression and asthenia, to lessen congestion, and to allay pains which are due to states which the vasomotor, osmotic, alterative, sedative-tonic action of the positive pole will relieve.

The direct application of the positive electrode upon a local part externally or within the soft tissues or natural cavities of the body is indicated by hyper-excitability of the nerve supply, by acute congestions and inflammations of soft tissues or glands, by the pains attendant thereon, by catarrhal inflammations of all mucous membranes in acute and subacute

stages, by irritation, redness and tenderness of a part, by soft, boggy, œdematous or bleeding states of tissues, glands, or glandular organs; but positive polar action in these applications must be properly regulated in dose and duration of sitting so as to meet indications for a great variety of effects. The positive pole is indicated in profuse uterine non-suppurative discharges, and in all electrolytic applications for denutritive, drying, coagulating, contracting, germicidal, hemostatic, caustic or acid cauterizing effects in local vascular dilatations, neoplasms and hemorrhagic states of the uterus. It is the pole employed in all the electrolytic uses of copper, zinc, silver, and mercury-coated electrodes.

The positive polar action is germicidal when combined with metallic electrolysis in purulent and gonorrhœal inflammations of mucous membranes and parasitic skin diseases with a much lower amperage than when acting alone.

The chief uses of the positive galvanic current in inflammatory, congestive and painful lesions, relate to the acuter stages and states of morbid irritability, with very mild dosage and short applications as the rule.

When the galvanic current is interrupted to cause muscular contraction, polarity becomes a matter of less importance, but the positive electrode may usually be placed upon or nearest to the origin of the nerve supply, and the negative pole applied upon the part which it is desired to stimulate functionally. When more rapid rates of interruption are employed for massage effects, the electrodes are usually placed so that they will act most effectively without regard to any chemical difference between the poles.

The negative galvanic polar action is chiefly indicated in the chronic stages of disease, to increase metabolic activity and stimulate the processes of repair, or to destroy and eliminate the morbid products of acute inflammations. Its electrolytic and complex electrotonic action arouses latent glandular, circulatory, cell, nerve, and muscle irritability. It is the pole for localized anæmic, atrophied, apathetic conditions, and

states of arrested functionation. By determining blood to a part and increasing local vascularity its action improves local nutrition. It is the pole to use to soften and absorb the chronic products of inflammation, exudates, indurations, enlarged glands, fibro-plastic deposits, fibrous growths, and to soften and relax scar tissue and contractured muscles.

Negative electrolysis destroys hairs, warts, moles, and other non-vascular growths. It promotes absorption of effusions, it softens and reduces a hard and enlarged uterus, dilates constrictions of canals lined with mucous membrane, destroys excessive granulation upon an eroded surface and promotes the healing of ulcerations. It stimulates the local blood supply of the pelvic organs and in scanty menstruation or amenorrhœa and other starved states it restores the nutrient activity.

Its softening and dissolving action overcomes stenosis and obstructions of the cervical canal and the indurated angle of a sharp uterine flexion, and it is the pole to employ in atonic and sclerotic conditions of chronic inflammation. Ankylosed joints, chronic arthritis, contractured tendons and muscles, and uterine fixation due to bands of adhesion, are usually to be attacked by negative polar electrolysis, followed in many instances by the mechanical action of an interrupted current.

Many pains are relieved by the negative pole or by the passage of a galvanic current through the parts without regard to polarity, and the presence of pain does not alone determine the choice of poles. The indications for the increase or decrease of local irritability and blood supply in a part, the acute or chronic nature of the lesion and the well defined indications for positive or negative electrolysis are more reliable guides to the therapeutic selection of galvanic polarity than pain.

The Choice of Faradic Poles.—No chemical differences of polarity affect the choice of faradic poles. In gross muscular applications with slow interruptions, place the electrode through which the current acts with the greatest vigor over the affected parts and the other electrode according to conven-

ience. In practice the most active polarity is the negative, unless a difference in the size of the electrodes is made to reverse the normal relation.

When rapidly interrupted, high tension, induction coil currents are directed with the blood current, they reinforce the vermicular movement of arteries, the peristalsis of involuntary muscles, and the functional activity of nerves. Vibratory impulses in the opposite direction diminish both nerve and arterial currents, and the reasons for these opposite actions are the different degrees of muscular contractility set up by what used to be called the in-going and out-going current. Knowing these effects of polarity in all general faradizations with medium or rapid rates of interruption we at once know how to apply the electrodes.

For sedative-tonic and nutritional effects in general applications to the entire body, the negative electrode is placed at the feet, or at the base of the spine.

For local sedation effects the positive electrode is placed over the site of congestion, inflammation, or pain, with the negative electrode situated so that the current will pass most directly through the affected parts.

Local stimulating effects depend very largely upon the management of the administration and can be accomplished without exact reference to polarity, but the negative pole is usually employed.

In all the remarkable range of effects produced within the pelvis by the bipolar method there is but one relation of polarity to remember. The positive terminal is always connected with the tip of the electrode. It is never used in any other way.

In passing currents through what may be termed cross sections of the body for conditions which do not actively indicate a definite location for any special polarity, but involve rather effects of general management and technique, we are governed chiefly by the size and character of the electrodes and operative convenience instead of polar action.

Choice of Static Poles.—With Leyden-jar currents the choice of polarity is governed by the same rules as induction coil currents.

With platform methods there is no chemical difference between positive or negative electrification, but one may be made more active therapeutically than the other on account of the difference of potential. Differences in sensory effects are most manifest in local applications when the higher-potential current (positive charge) encounters resistances or attractions. The two poles represent chiefly a greater and lesser potential of similar current action rather than opposite polarities.

I insulate the patient positively, as a general rule, in all cases of simple electrification for sedative-tonic effects, unless I am treating, for the first time, a new and timid patient whose wearing apparel might be "irritating," and whom I wish to introduce to the machine in such a manner as to avoid the most remote possibility of alarm.

I insulate all patients negatively for the purpose of giving a mild, positive spark. If I am dealing with sluggish, insensitive, and thickened tissues, requiring the most vigorous and stimulating spark that can be applied, without the regard to comfort which sensitive tissues would require, I change the electrification to the high potential. I insulate all patients negatively for an ordinary mild positive breeze effect, and only change to positive electrification and negative breeze when a counter-irritant effect is desired.

With smaller apparatus, however, and non-metallic connection between patient and machine the results which I thus secure cannot be duplicated with negative electrification, because the current is not powerful enough. The operator, however, can substitute positive electrification when it is necessary.

Practical Operative Methods.—The greatest perplexity in the path of electro-therapeutic development among general practitioners is the kaleidoscopic mixture of methods which appear to be recommended and which are made still more

mystifying by the indefiniteness with which they are described. Special terms have been suggested by different generations of writers to indicate some individual and peculiar technique. These terms float before the mind of the physician in his library and seem to baffle an understanding of the subject. Men following the teachings of Remak (who used only the galvanic current) and men following the teachings of Duchenne (who used only faradic currents) have accomplished wonders in the development of narrow and limited methods of application *which are utterly useless to the general practitioner.*

The joint influences of the teachings of specialists have nearly exhausted the art of making electro-therapeutics difficult. The attempt to push to its extreme the theory of treating a patient with strictly local applications makes it necessary to go to a great deal of trouble and enter into refinements of technique which do credit to the ingenuity of the school of Duchenne but which are based on mistaken judgment. On the other hand, the attempt to recognize the soundness of the theory of treating constitutional diseases by general electrization, received theoretical justice from some of the earlier electricians, but they made the great mistake of trying to turn local methods into general in the most difficult and tedious way. They ignored the general capabilities of the static currents which a previous age had demonstrated to be superbly adapted to constitutional treatment, and they clung with singular tenacity to the galvanic and faradic currents which are best adapted to local applications, and which the ingenuity of man cannot transform to meet the requirements of convenient general electrization in office practice.

No one who is not broad enough to use each separate current for its best purposes can make easy work out of electro-therapeutics. The vain effort to fulfil indications with the galvanic current alone, as did Remak, or with the faradic current alone, as did Duchenne, or with the static apparatus alone, as the men of the eighteenth century were obliged to

do, is an act of folly which can lead only to disappointment. The electro-therapeutic literature which is filled with unnecessary and in many cases preposterous methods of trying to overcome the limitations of a single current and make it answer for purposes to which another current is vastly better suited, makes up an undigested mass of operative technique, which distracts the reader and often turns him from the subject in despair.

Now, as a matter of fact, it is only necessary to employ each current by such simple methods as procure the action of its best properties to make up a selected sum-total of electro-therapy which will be found to possess the great qualities of practical simplicity, clinical usefulness and satisfactory results. The apparatus which straightens out the bewildering mazes of medical writings on this subject, and makes a general electro-therapeutic office practice a feasible and satisfactory department of medicine, is the static machine. It enables the operator to obtain results, to successfully treat a far greater number of patients in a given time, and to wholly ignore many of the distracting methods of using galvanic and faradic currents for work which they are not well able to do.

It is therefore not my purpose to include in this book every method of operative technique that can possibly be described. Nor shall I attempt to show how great a variety of methods can be incorporated into the uses of a single current. The practitioner does not want confusion added to confusion and his perplexity increased. What the profession needs is rather a *simplification of the whole matter along the lines of practical technique.*

This is my purpose in writing this book, and it will be found that by the use of a few plain and practical methods of employing the best therapeutic properties of each different current, in its own proper sphere of action, we can arrive at results which involve no more trouble than any other branch of practice.

Surgical instruments can often be used in variou ways to

achieve the same end, and so can electric currents. Electrodes are often but the means of completing a circuit of therapeutic action and the needed contact can be made as well in one way as another out of a choice of several correct methods. This, to a great extent, accounts for the endless variety of applications described by different authors. It is better for us to be guided by a few fundamental principles than to memorize a thousand "applications." The well-equipped specialist whose work is limited to a narrow field may employ a few methods occasionally which the general practitioner never needs; but with these few exceptions I shall describe methods which embody the greatest simplicity with practical value throughout the therapeutic range of electric currents.

Doubtless the perplexity of the average practitioner who rises from the study of various text-books is also increased when he examines the catalogues of different makers with the view of selecting electrodes. Many of the peculiar electrodes illustrated in catalogues are not used at all. Some of them have a limited use in the hands of specialists. Others crop out of attempts to make a single current do the work which must be divided between three currents, and are therefore needless to the well-equipped practitioner.

Satisfactory electrodes may be of a very simple character, and so far as it is possible the directions in this book will be accompanied by illustrations of the electrodes used. Several pages could be filled with cuts of electrodes which have been recommended during the past thirty years, and which still meet the eye of the physician who consults reference books and catalogues, but which are obsolete in practice.

Length of Seances.—In all electro-therapeutic applications of either galvanic, faradic, or static forms of current, the length of the sitting is always a factor in dosage. The physician will always ask himself what the proper length should be, but in the beginning of his experience he may puzzle over the answer.

The fact is that electrical effects are dependent on intensity of action, and the time limit must carry these effects to the desired point and then stop. Time and intensity are not convertible terms in the uses of either electricity or heat.

To illustrate: Take a hot oven that will bake biscuits properly in fifteen minutes. Call this unit of heat one, reduce it four times and multiply the time the biscuits are in the oven by four. One-fourth of sixty minutes is still fifteen minutes, but the result will not be a well-baked pan of biscuits. During their hour's sojourn in the lukewarm oven they would be simply dried and unfit to eat.

Now multiply the unit of heat by four and reduce the time limit in proportion, and we would find that the great intensity of heat action now going on in the oven would not properly cook the biscuits in three and three-quarter minutes, but would burn them so they could not be eaten. These principles apply to the uses of electric currents in medicine, and the exact regulation of intensity and time becomes instinctive with the trained operator, although it is exceedingly difficult to write directions for the explicit guidance of the beginner.

What is here said about heat effects relates most closely to the chemical polar action of galvanic currents applied with bare metal electrodes, but the idea conveyed is applicable in principle to all medical currents.

Stimulation is generally a quick process and the application short, for over-stimulation is not desired any more than exhaustive fatigue is indicated when we recommend beneficial exercise to a patient. Therefore the application of electricity by special methods for the particular purpose of either local or general stimulation involves short sittings of a few moments.

Counter-irritating applications are regulated as to time by the same principle and are very short.

General tonic applications of electricity involve slower-acting methods and take more time. Probably fifteen minutes is an average length of treatment for this purpose.

Sedation involves an opposite principle and still slower

method when the condition attacked is extreme, and present relief must not only be obtained but more permanent effects aimed at.

Local circulatory sedation is often as quickly affected as local stimulation, but these remarks are directed to neurasthenic and hyperexcitable general states rather than local. Time in these cases must be extended beyond short *séances*, and persisted in until effect is secured, whether it takes twenty minutes or half an hour.

In a doubtful case a few additional moments is a safe allowance, for we cannot over-soothe, over-rest, over-refresh and vitalize an exhausted nervous system.

CHAPTER IV.

THE ESSENTIALS OF GALVANIC ELECTRO-PHYSICS.

Cells, elements, and switchboards. Portable galvanic batteries. Exciting fluids. How to connect a meter in circuit. Milliammeters. Rheostats. Accessory appliances.

LET us now make clear the "physics" of each special current. They are equally simple and can be mastered in a day.

The practical part of the subject of electro-physics for the physician to first understand is how to operate and keep in good order his electrical apparatus. The first form of apparatus to consider is the galvanic.

The galvanic current results from chemical action within primary cells.

The cell of the medical battery consists of an electro-positive element (usually zinc) and an electro-negative element (usually carbon) contained in a glass jar filled with a solution of salts called the exciting fluid.

The chemical action is the decomposition of the zinc by the "excitant" solution in which the zinc and carbon elements are immersed.

The zinc element is amalgamated with mercury to secure a uniform electrolytic action upon its surface and prevent irregular and too rapid decomposition. Such a cell will produce an electric current of the type known as galvanic when conducting wires from the two elements are placed in contact, *i. e.*, form a circuit. Such a metallic circuit is called a "short circuit," and the initial value of the current from a single cell is about 1·5 to 2 volts, and from 1·5 to 5 amperes, according to the size of the elements.

For clinical work this enormous amperage is too much and

the voltage far too small, as the moment the resistance of the patient enters the circuit Ohm's law divides the voltage of the current by the resistance to produce a net current flow for medical action.

To obtain, therefore, an amount of current sufficient for the treatment of different patients requiring a wide range of dosage (from 1-10 to 250 milliamperes) to produce different effects through different resistances (which may vary from a few ohms to nearly 2,000), a considerable number of such cells are joined together so that each adds its E. M. F. in a continuous *series* of increasing volts from the first cell to the last. This arrangement is called "connecting in series," and no other method is employed in any medical battery except a cautery battery. It consists of wiring the zinc of one cell to the carbon of the next (which is also wired to one of the respective switch buttons of the switchboard and its mechanism) throughout the entire number of cells in the apparatus.

For the reason that some applications may require only two or three cells, while others may require ten, twenty, or fifty, a switch device called a cell selector is provided to switch in or out of circuit the exact number of cells we wish to use in a given case. For the reason also that galvanic current strength must be increased and decreased gradually, a rheostat is included in the galvanic circuit in order that the gradations of dosage may be free from sudden starts and disagreeable sensations. Such a current controller is now an essential part of a complete apparatus of this kind, and no office cabinet is fitted for work without a good rheostat.

The *battery cells* are the automatic source of the current and generally the invisible part of the galvanic apparatus. The *switchboard* is the mechanical part of the appliance which is manipulated by the physician during treatment of patients. The operator must therefore be familiar with its management. Manual dexterity in this respect is a prerequisite in electrotherapeutics, and the necessary skill is quickly obtained by practice. Operative directions cannot be given for all switch-

boards, as they are not alike in arrangement although they must follow definite principles of construction.

The essentials of a complete high-efficiency galvanic cabinet are 50 or 60 large cells, a milliammeter, rheostat, automatic interrupter, pole changer, cell selector switch, two terminal binding posts, base and auxiliary parts. Several pairs of conducting cords of copper wire (one pair bifurcated) are necessary,

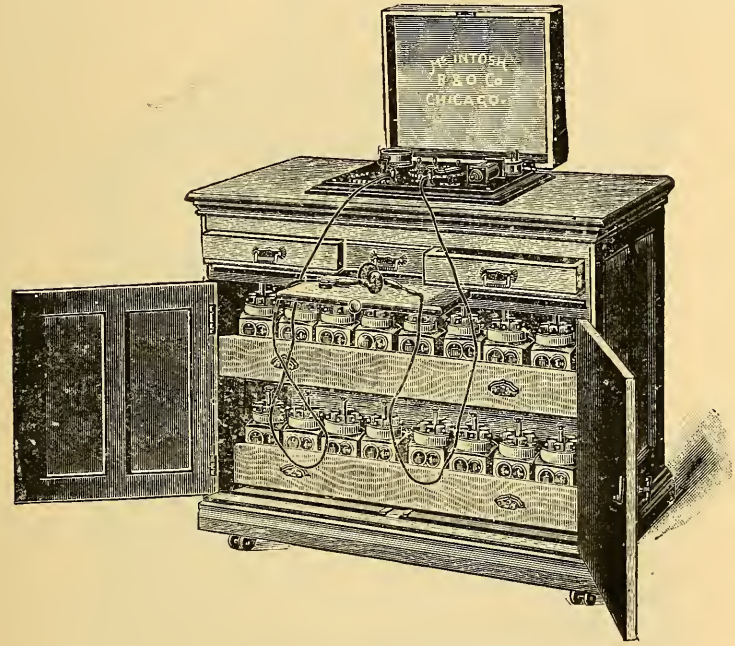


Fig. 2. Complete galvanic cabinet.

and the outfit of electrodes will grow with time, as clinical needs arise.

It was formerly popular, before the days of improved induction coil apparatus, to include a coil attachment to the galvanic switchboard. It is sometimes, however, very undesirable to have both these important and very different therapeutic appliances anchored immovably in one cabinet. The coil apparatus, when in a separate case, is always portable, and in practical work there are innumerable occasions when it is

wise to have entirely separate apparatus for each form of current.

In purchasing a galvanic equipment of the stationary cabinet

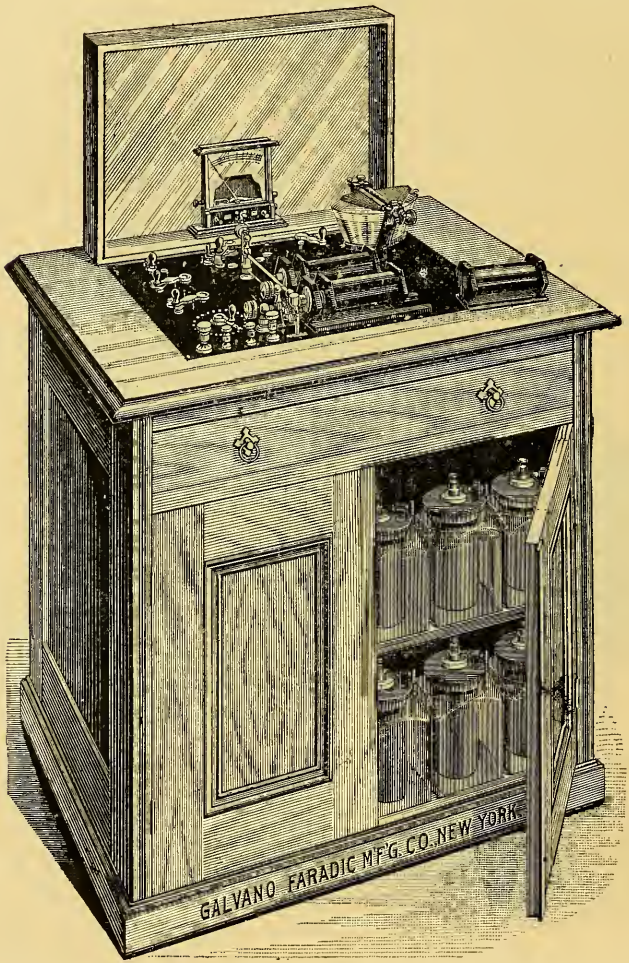


Fig. 3. Galvanic office cabinet containing fifty cells, meter, rheostat and faradic coils.

type many physicians ask, "Which is the best cell to buy?" It is useless to read descriptions of different cells to form a conclusion on this point. There are several varieties, and new ones make their appearance from time to time. The physician

has but to go to any one of the best makers of electro-medical apparatus to obtain the latest and best.

Any of the leading cells may be considered adequate for the therapeutic requirements of the largest practice, and from 40 to 60 is a sufficient number. The size of a cell does not determine its voltage, and therefore no increase in size will do away with need for the number of cells required in all galvanic batteries; but large cells not only provide a greater amperage, but possess more capacity and endurance than small cells.

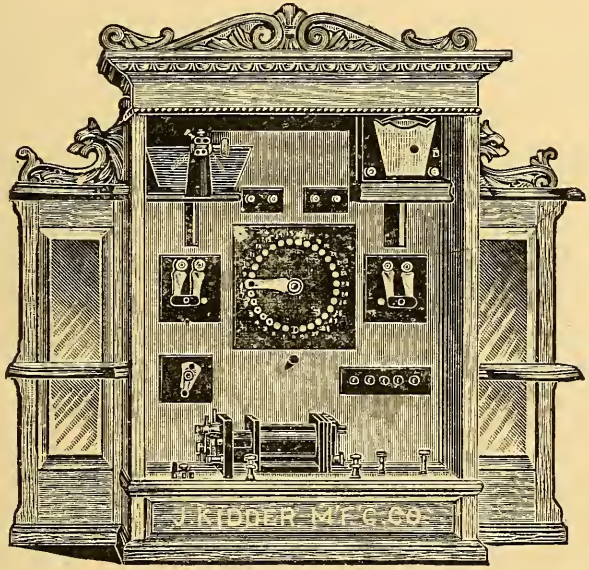


Fig. 4. Switchboard (Wall cabinet.)

All improved cabinet batteries are fitted with large cells which seldom need renewing and are perfectly satisfactory.

Workmen for the manufacturer usually set up a new cabinet battery for the purchaser, but if attempted by the physician himself, it is important to keep every external surface dry and clean. If water is spilled in filling the jars the salts will soon creep over the outside. If two bare copper wires are by accident left touching each other the cells they join are "short

circuited." This at once creates an excessively rapid chemical action, destroys the zincs and precipitates the salts in crystals. The fluid is discolored, and a glance at the cells shows that they are "polarized."

When any unusual deficiency of current strength is discovered, either by a test or in attempting to treat a patient, the operator should look at each cell to detect signs of exhaustion, and if none are discovered the various switches and wires should be examined to see if the contacts are all in proper order. Accidental polarization ought never to happen with a properly set up battery.

A new cabinet battery in good order should keep so for a long time without further attention, and, if restricted to therapeutic uses and not injured by experiments, a good set of cells will run about two years without any expense whatever. Accidents may impair and the experiments of the beginner may shorten the life of any good chemical cell, but when it is run down, only the fluid, salts and zinc element need renewing, and these cost but a few cents.

Special excitant salts are prepared in packages, each package sufficient to charge one cell, and full directions are printed on the label, so that no study of this matter is necessary for the practitioner.

Portable Galvanic Batteries.—In office work a portable galvanic battery is sometimes a convenience, but in general practice it is a necessity. It is not, however, the highest type of galvanic apparatus and possesses drawbacks. Fluid cells are usually employed, as the dry cells which answer the purpose of broken currents are not satisfactory with the constant current.

To be portable the apparatus must be compact, light, and undisturbed by transportation. For this reason the cells must be few in number and small in size. From 12 to 24 glass, or hard-rubber, cells holding two or three ounces of fluid each are generally supplied in the portable case. The apparatus is not equipped with meter, rheostat or automatic interrupter,

and these omissions limit its completeness. It is not a substitute for the high-efficiency office cabinet.

The exciting solution for small portable cells must be more concentrated and active than the fluid in large cells, and hence it is speedily exhausted and requires to be freshly made at short intervals. In this respect the small battery is much more troublesome than the large cabinet, which does not require any attention to the cells except at perhaps intervals of two or three years, barring accidents.

When not in use the elements of the small acid battery must be invariably lifted out of the fluid or they will corrode and waste, while in large alkaline batteries the elements remain immersed all the time without injury. In some portable batteries the cells are lifted up to the elements to immerse them for action, and in others the elements are let down into the cells. The principle is the same in both cases. To prevent the spilling of the fluid when the case is carried, and to separate the cells and elements during non-use, a rubber-covered board, called a hydro-stat, is placed between them.

As the satisfactory use of the apparatus depends upon its working order it is necessary to know the best and simplest way to clean and refill a battery that has deteriorated.

First, remove the switchboard with the elements attached. They will be found to be dirty and coated with crystals and a greenish scum. Let them stand in a pan of cold water plus a tablespoonful of salt while making new fluid. Have the water reach nearly to the top of the elements but not wet the switchboard. Empty out the old fluid from the cells and wash them thoroughly.

Take an ordinary crockery pitcher and put into it four ounces of pulv. bichromate of potash. If this is reduced to powder it will dissolve more readily than the crude crystals. Pour one quart of boiling water into the pitcher; stir the solution a few moments with a wooden stick and set it aside to cool. When thoroughly cooled add commercial sulphuric

acid, three ounces, and again set the pitcher aside until the heat evolved by the mixture of the acid passes away.

This part of the battery solution contains nothing to amalgamate and protect the surface of the zinc elements, and mercury must be added in some form to make it effective. Crude mercury cannot be used in solution, and if the usual bisulphate is added to a cold fluid it will not dissolve. The best method known to me is as follows:

Take Nitric acid (commercial), ℥ iv.
Muriatic acid, ℥ iss.
Bisulphate of mercury, ℥ i.

Place these together in any small bowl or pitcher and carefully heat in a water-bath. Heat and stir until the mercury is dissolved, then set aside to cool. When cool add two ounces of commercial muriatic acid. This formula prepares four ounces of a mercuric solution which will keep until used, and a fresh supply need only be made at long intervals.

When the bichromate solution is thoroughly cool, add four drams of the mercuric solution and the complete excitant is then ready to pour from the pitcher into the cells of the portable battery. If the capacity of these cells is greater or less than one quart the quantity may be varied to suit. Each cell should be filled only about two-thirds full to allow room for the immersion of the elements without causing an overflow. The bichromate part of the solution must be freshly prepared whenever the cells are run down, and with some little daily use of the apparatus this will occur about every three to six weeks, although the endurance of the cell will vary according to use and care. The mercuric solution should only be added to the freshly made fluid when ready to put into the cells.

The separate steps of mixing fresh battery fluid require but a moment's time, although twelve or twenty-four hours should be allowed for cooling before the elements are immersed. Never use a fluid so recently prepared that it is still warm, as it would attack the elements too rapidly and waste its strength.

Meanwhile the zincs and carbons have been soaking in the

strong salt solution where they were placed when we began to mix the fresh solution. The water around them is now seen to be discolored a greenish hue, and a sediment has collected in the bottom of the pan. Lift the elements from the salt solution, rinse them with plain water and wipe them thoroughly with a soft rag. When as clean as they can be made they are ready to return to the apparatus. The process is then complete.

Although small portable galvanic batteries are not constructed with a milliammeter or a rheostat, yet they are ar-

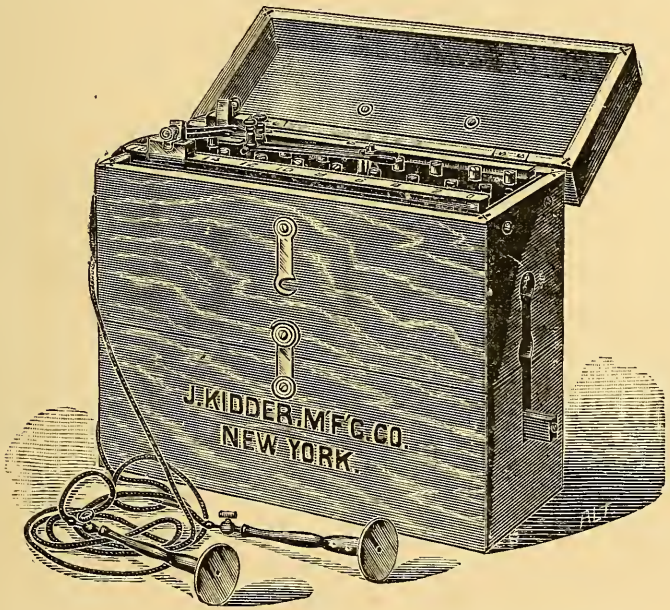


Fig. 4*a*. A compact portable galvanic battery containing sixteen cells.

ranged so that the current strength is increased by a single cell at a time, and this answers instead of a current controller for many ordinary external applications with medium or large electrodes.

Refinements of treatment, however, require refinements in methods and apparatus. A meter should invariably be supplied in the circuit by the physician. It is easily done. Sim-

ply place a portable milliammeter on the table beside the battery and level it with the needle pointing at zero. Connect a short wire between the positive pole and one binding post of the meter. To the other binding post attach the conducting cord from the positive electrode. Connect the other electrode to the negative pole of the battery in the usual manner. When the electrodes are applied to the patient and the battery started into action the meter will be interposed in the direct pathway of the current, so that it will register the amperage flowing through it as if it was a fixed part of the apparatus.

The question may be asked, "Upon which binding post of the meter to attach the wire from the battery?" With some meters it makes no difference, but if any physician finds that his own instrument does not work properly when connected in one way it is a simple matter to transfer the connections. It will simplify many of the questions which perplex the beginner in the uses of medical electricity to remember that there are only two poles to a switchboard, and if one is not right the other must be.

Milliammeter.—In general estimation the rapid progress of galvanic therapeutics during the past ten years is ascribed to the accuracy in dose measurement afforded by the milliammeter. It is this single instrument of precision, adopted universally within half a decade, which is said to have lifted the galvanic current from the uncertain methods of empiricism and given scientific exactness to its employment. This instrument is a calibrated "galvanometer," which had its origin in Oersted's discovery, in 1820, that a freely suspended needle is deflected by the passage of a current of electricity in its neighborhood. When milliammeters began to be more generally employed by physicians, and prior to 1893, few of them were accurate instruments of precision. Some of them would register from seventy-five to more than a hundred mil. when the actual current was less than fifty. Much of the unreliability which the expert recognizes in published reports about current strength has been due to differences in meters.

The meter indicates the "amperage" (or rate of flow) of the continuous galvanic current. This current is silent in its flow and physiological activity. Without an indicating instrument we may be in doubt whether or not the battery is in action until the current is strong enough to be felt by the patient, and as a guide to therapeutic doses the patient's sensations are very incompetent.

Owing to the feeble power of E. M. F. possessed by the constant current, an enormous range of uncertainty enters into every galvanic application without a standard meter in the circuit; for the actual current strength, from the same number of cells and with the same electrodes, will vary greatly with the degree of resistance of the skin, so that similar conditions, such as using the same number of cells as for a previous treatment, are no guide whatever to similar doses and effects at the next treatment. If two physicians simultaneously conducted the same application with exactly similar apparatus, upon exactly the same tissues, the single difference of wetting one set of electrodes with plain hot water and in the other case adding about two per cent. of bicarbonate of soda would make such a difference of dosage as to be incredible to any one unfamiliar with the subject. The actual value of the dose in each case can only be determined by the milliammeter, and this fact renders it indispensable.

Meters may be portable, or attached permanently to the switchboard. They are made to read with various scales for large or small currents, and stand in either an upright or horizontal position. The perpendicular scale is the most convenient to read while treating a patient. A *balance* meter will often over-bank if the poles are reversed suddenly, and cannot be made accurate.

The best meters are of the permanent magnet type. A meter that is not standardized and guaranteed to be accurate by a reliable maker is not a suitable instrument for medical use. Some meters which are accurate at the beginning gradually lose their magnetic saturation and require to be standard-

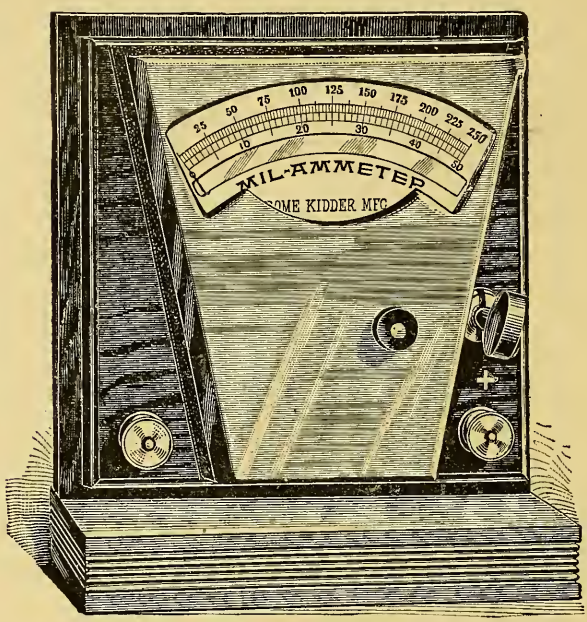


Fig. 5. Milliampere-meter.

ized again after a few years. Cheap meters are a dear investment at any price. The most satisfactory meter in my own equipment is illustrated in the accompanying figure. It never fails to act properly. The needle never sticks. It needs no tapping to start the pointer. It does not over-bank when polarity is reversed. It is exceedingly sensitive and possesses a dead beat attachment so that the needle can instantly be brought to rest by pressing a knob. By a turn of the same knob the needle can be locked, and when a portable form is employed this permits transportation without injury. The magnets are permanent and obviate future calibrations. It possesses a double scale reading from zero to fifty mil. for small currents, and from zero to two hundred and fifty mil. for larger currents. It is in all practical ways a fine and reliable instrument and is handsomely mounted. I am perfectly satisfied with it.

Rheostat.—The current controllers, of improved form for

use with galvanic currents, are chiefly of two types, one of which is dry and the other wet. Both serve for the satis-

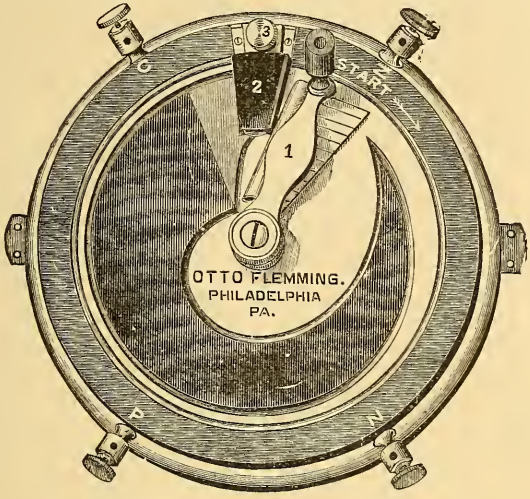


Fig. 6. Graphite current controller.

factory regulation of current strength, and each possesses advantages and minor drawbacks. A water rheostat requires to be refilled, and a carbon rheostat also requires occasional attention. A rheostat is indispensable, and the physician may be certain of obtaining a satisfactory instrument from any reliable dealer, as there are a number of varieties in the market.

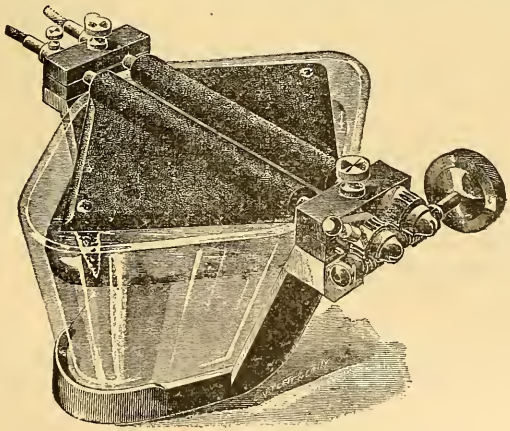


Fig. 7. The new Bailey current controller.

Being simple in construction, they do not present the difficulties which enter into the making of a reliable milliammeter.

This instrument consists of two triangular-shaped carbon plates, each carrying a conical sponge at one of its angles, and mounted over a glass vessel containing water. By means of a worm gear, operated by a thumb knob, the sponge tips are gradually immersed into the water and towards each other. This current controller, or rheostat, will increase the current without variation or fluctuation.

Accessory Appliances.—There are a number of small accessories required for complete electrical equipments. Controlling and regulating devices, conductors, electrodes, and various other conveniences are provided in patterns which differ somewhat, according to the ideas of the maker or buyer.

Petty annoyances are oftentimes serious obstructions to what might otherwise be the most efficient and desirable methods of treatment. A disagreeable shock to a patient, or a failure in getting a current at a critical moment, when neither the time nor the occasion is suitable for searching out the cause, has induced many a physician or surgeon to abandon electricity as an aid to therapeutics when no other agent would serve him so well. The loss of a binding screw or a defective cord conductor may prove as vital to the success of electro-therapeutic work as a broken coupling pin to the proper running of a moving train of cars. Any improvement, therefore, which will avoid such obstacles in the practical

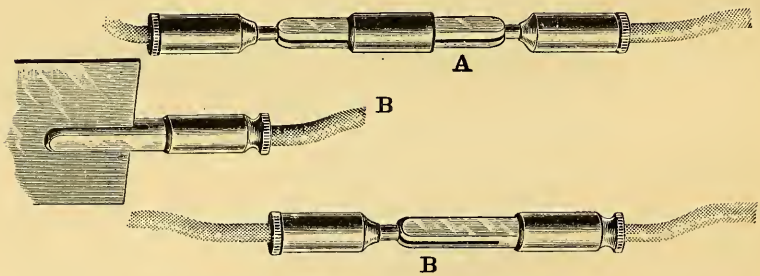


Fig. 8. Convenient connectors. (McIntosh.)

workings of electro-therapeutic apparatus is a blessing to both physician and patient.

A very simple and efficient substitute can be adopted for the old form of connection by which all of the annoyances incident to it can be avoided. By the use of a universal spring slot connector, such as is shown in Fig. A, a perfect contact can be readily made with corresponding simple terminals on batteries and electrodes. For some time spring slot connections have been made, both for cord tips (as B) and electrodes, but the universal connector takes the place of all these special devices, and at the same time greatly simplifies the construction of electrodes and battery contacts.

Fig. 9.

C. Universal Cord Tip Connector, to connect cord tips of any battery.

E. Universal Electrode Connector, to connect cord tips of any battery with Electrodes.

D. Double connector, for wire or cords.

Fig. 10. Adjustable cord tips.

Up-to-date information in regard to all accessories may always be found in late catalogues of leading manufacturers, and need not be copied into a book of this kind.

Having practised the technique of managing a galvanic switchboard, let us see in the next chapter what effects we can produce with this form of apparatus.

CHAPTER V.

PHYSIOLOGICAL AND THERAPEUTIC ACTIONS OF GALVANIC CURRENTS UPON AND WITHIN LIVING TISSUES.

THE influences of the constant galvanic current upon and within living tissues in health and disease are those which result from the electro-chemical and dynamic actions of a (medically) large volume of electricity without much pressure behind it to impart mechanical force. The medical properties of all currents alter in proportion to the relation between their voltage and amperage, and when one is high and the other low the effects of one predominate at the expense of the other. Amperage is the predominating factor in galvanic currents, and in medical uses only sufficient voltage is present to push the desired number of milliamperes through the tissues.

Medical galvanic currents may be either continuous or interrupted, but are almost wholly employed in their constant form.

The constant galvanic current possesses complex polar and inter-polar properties which are generally grouped under four heads,—cataphoric, electrolytic, catalytic and electro-tonic. These conventional terms merely represent various sides of a complex influence of currents according to the nature of the tissues acted upon, and are not distinct and independent properties although any one of them may be made to become the predominating therapeutic action during treatment.

When the semi-solid substance of muscle or the fluid constituents of the body are subjected to the inter-polar action of a constant galvanic current of sufficient strength, there is an osmotic and cataphoric determination of the products of electrolytic action from the positive electrode toward the site

of the negative electrode. From this osmosis results physiological effects which are fluid lessening, anti-congestive and denutritive at the positive pole, and fluid increasing and congestive at the negative pole, with ordinary protected electrodes and mild dosage. The lessening of the capillary fullness at the positive electrode will also be sedative in congested conditions with their accompanying pains, and the increased capillary blood supply at the negative region will be locally nourishing, stimulating, derivative and alterative in the opposite pathological states.

Degrees of these effects will be regulated by the *current* dose. The intensity of drug action depends upon the *drug* dose, the effects of heat depend upon the degree and management of the *temperature*, the effects which may be produced by a main of water are limited by the *pressure* and *volume* of the current, and degrees of intensity in the effects which electric currents are caused to produce are regulated by similar principles of managing this agent. Every added milliampere in a galvanic medical current represents an increase in the rate of flow, the volume and pressure force of the current, with a corresponding intensification of its processes of dynamic action.

When the compound saline fluids and semi-solid tissues of the body are subjected to the direct polar action of a medical galvanic current by the metallic contact of electrodes the modifying and protecting influence of felt, absorbent cotton, sponge and other coverings is removed and the full phenomena of polar electrolysis takes place. At the positive pole the chemical decomposition liberates the oxygen and chlorine of the tissues and collects acids (sulphuric, nitric, hydrochloric, and phosphoric), and hence blanches, hardens and dries in proportion to the electrolytic activity.

Thus, in hemorrhagic states, it is the contracting, astringent, coagulating and drying pole. With a mild current this local polar action is simply styptic; with a stronger current it is a chemical hemostatic; with a still higher intensity (above about thirty milliamperes) it is chemically caustic, and in higher doses

of from 50 to 150 milliamperes it produces more and more active actual cauterization as the intensity rises. The *positive* current attacks metallic electrodes with electrolytic action, forms new double salts with the nascent base, pushes these products into the tissues by osmotic and cataphoric action, and is therefore the polar influence employed in most of the various forms of cataphoric medication and metallic electrolysis.

The *negative* polar influence, on the contrary, under the same circumstances of application, liberates hydrogen and attracts the alkalies of the body fluids (sodium, potash, lime, ammonia), and hence has a softening, liquefying, hemorrhagic action. The negative pole, therefore, electrolyzes, softens, relaxes and congests in moderate doses, becomes caustic in larger doses, and finally also cauterizes under the contact of a bare metal electrode. The scar of a negative burn upon the skin is pink and soft, resembling that of an alkaline caustic, while the scar of a positive cauterization upon the skin is white and hard, resembling that of an acid caustic, but burning is not a part of the therapeutic uses of either pole. For actual cautery work another apparatus is employed.

The *electrolytic* power to decompose metallic and organic compound substances gives to the polar action of the galvanic current a valuable diversity and wide range of action, for we have not only two opposite polarities and a variety of metallic electrodes which deposit antiseptic, astringent and alterative salts within the tissues, but we graduate the action, both in kind and degree, by the intensity and duration of the current flow. We can regulate the *dose* exactly.

Catalysis was a term applied by Remak to the properties of galvanic current action in general which supplement cataphoresis and electrolysis by dilating the blood vessels and lymphatics, stimulating glandular secretion and increasing the powers of absorption and osmosis in the negative region, and doing the reverse in the positive region.

In addition to these effects Remak included under the term catalysis the influence of the galvanic current upon molecular

exchange and nutrition due to exciting (or soothing) the nerves themselves, or the parts which they supply; also the changes in the molecular arrangement of protoplasmic structures and in their nutritive activity produced at the same time, and, finally, the consequences of the mechanical transference of fluids and salts from the positive towards the negative pole.

While *electrolysis* is the prominent local polar effect the term *catalysis* conventionally indicates the general alterative, electrotonic and electro-sedative inter-polar actions of the galvanic current. These actions affect nutrition—increase it in moderate dosage and decrease it in excessive dosage.

With every galvanic application in a continuous form there is some effect upon both striated and non-striated muscular fibres. This increases with the amperage and voltage until a tetanic contraction is set up at the positive pole. The *electrotonic* action throughout the positive path of the continuous current decreases muscular excitability and soothes an irritable nerve. In the negative part of the current muscular and nervous irritability is increased.

All nerves of special sense are excited by the passage of a galvanic current through or near them. Its flashes of light and metallic taste are familiar to all.

When the galvanic current is interrupted its electrolytic action is interrupted, but muscular contractions are produced which are effective in dispersing the products of previous electrolysis, and which possess a greater influence in promoting the nutrition and function of paralyzed muscles which have undergone atrophy and degeneration than the contractions produced by induction coil currents of higher voltage but of very much less amperage.

The galvanic current may be interrupted by an automatic rheotome with varying rates of rapidity, but in practice we require to employ only rates of from about 70 to 100 per minute for muscular exercise, or a rate of 300 or 400 per minute for local massage effects. Rapid interruptions such as are produced by the rapid vibrator of a fine induction coil appara-

tus are not practical with galvanic currents, and single impulses are made by hand, so that the automatic rheotome is chiefly employed for medium and low rates.

With the constant current a low amperage and medium or large electrodes, covered with some protecting material, are employed in ordinary external applications when we wish to produce chiefly the effects which have been called *catalytic*, but which it seems more rational to call *nutritional;* for we desire these effects when we seek to improve nutrition, promote circulatory energies, vitalize the nervous system, build up atrophied muscles, stimulate glandular and nerve cells, and "assist nature to restore the sound state." In these cases the dose will usually range from five to twenty milliamperes with small or medium electrodes, and with larger electrodes may be increased from 30 to 60 milliamperes without much altering the current density.

In *metallic electrolysis* and *cataphoric medication* with the positive pole we must employ sufficient density to accomplish results, viz., to decompose the metal and push the medication into the tissues. In addition to the chemical action of amperage it is also here a matter of voltage against resistance. The current strength required for these purposes will vary according to the conditions of the application, the size of the electrode and the degree of effect desired. The meter will register from 5 to about 20 milliamperes in different cases with different sizes of electrodes. See section on these subjects for fuller details.

In *negative* electrolysis for the softening and relaxing of indurated, contractured or cicatricial tissues, to resolve exudates and promote absorption, the external dosage with protected electrodes will follow the usual rule of current density up to comfortable tolerance of the patient, and this tolerance may be greatly increased by proper preparation and application of the electrodes, as will be described hereafter.

With bare metal electrodes employed to dilate a mucous-lined canal a strong current would defeat the object and

moderate currents are more effective. A current of from five to fifteen milliamperes will correct an ordinary stenosis of the uterine os and facilitate drainage in a way that no other method can equal in cases to which it is suited.

The destruction by *negative electrolysis* of small growths upon the skin or mucous membrane is performed with fine needles or broaches of such limited surface area that the currents employed seem to be very small, but they represent nevertheless a high density. One half a milliampere will cause an intense liquefying action at the point of a small needle in a hair follicle, and two or three milliamperes will quickly produce sufficient action for the destruction of a small nævus. To appreciate the active character of such a dosage we have only to multiply the amperage by the greater contact area of any large electrode.

It is chiefly in gynecological work that the greatest range of current strength is employed, and the application of more than 50 milliamperes is almost exclusively limited to this field and to joints and tumors. In intra-uterine applications with bare metal electrodes nutritional, sedative, tonic, alterative, stimulating and other effects below caustic electrolytic action are secured with doses ranging from zero up to about 30 milliamperes.

Galvano-caustic effects require a range of dosage from 30 to about 75 milliamperes, depending somewhat upon the state of the tissues, duration of treatment and the size of electrode.

Cauterizing effects for the gross destruction of tissues which is desired in the treatment of fibroid tumors demand intensities usually ranging from 80 to about 100 milliamperes in ordinary practice, with sittings of from ten to fifteen minutes in length. In special cases and for two or three minutes only the amperage is carried up to 150, in rarer cases up to 200, and occasionally up to 250 milliamperes. The highest rates are now less used than formerly, and early reports of the use of from one to three hundred milliamperes are no guide to the actual facts, unless we know that the meter registered accurately.

Many of the cheap meters employed to-day and almost all the meters that were employed previous to a very recent time fluctuated in their measurements and often recorded a greater current than was employed.

The therapeutic possibilities of galvanic currents are comprised within the following limitations of operative technique:

1. The application can only be either a constant or interrupted current.

2. The active polarity must either be positive or negative, or may alternate.

3. The application must be local or general, and if the latter it is usually the single method called central galvanization.

4. The polar or inter-polar properties of the current may be made to predominate within the tissues treated.

5. Covered, or bare metal, electrodes of different sizes, shapes and material may be employed, labile or stabile.

6. Medication by either cataphoric methods or metallic electrolysis may be added to current action upon mucous membranes and within soft tissues, and all soluble remedies may be driven into or through the skin.

7. Each local or general effect of the galvanic current may be increased or diminished by regulation of the current density and duration of sitting.

This surveys about the whole field of galvanic technique, if we include needle puncture among the uses of bare metal electrodes.

Synopsis of Constant Current Properties in Clinical Applications.—*Positive polar action* with protected electrodes: sedative to nerve irritability, tonic to nerve and muscle fibre, anti-congestive, osmotic, pushes fluids towards negative electrode. Strong currents produce counter-irritation, heat and pain beneath the electrode, and will finally vesicate.

Negative polar action with protected electrodes: increases nerve excitability, relaxes fibrous tissues, attracts fluids from the positive pole.

General inter-polar action: Nutritional, electro-tonic, sedative, anodyne, alterative, warming, refreshing, vitalizing. Electrolytic action is modified and special effects depend upon relation of electrodes, state of tissues, strength of current and time of current flow.

Positive local polar action with non-attackable bare metal (platinum) electrode within soft tissues:

With mild currents, sedative, tonic, nutritional, anti-congestive, astringent, hemostatic, muscle-contracting, mildly osmotic, cataphoric and electrolytic.

With medium currents, styptic, coagulating, drying, shrinking, muscle-contracting, anodyne, denutritive, anti-hemorrhagic, antiseptic, osmotic, cataphoric and electrolytic in proportion to current strength.

With strong currents, blanching, drying, denutritive, coagulating, hardening, muscle-contracting, antiseptic, germicidal, cataphoric and caustic, rapidly increasing to cauterization with gross destruction of tissues as amperage increases. The positive cautery scar contracts.

Negative local polar action with any bare metal electrode within soft tissues:

With mild currents increases capillary circulation and nerve and muscle excitability; mildly osmotic and electrolytic; alterative, relaxing, dilating, nutritional, healing to ulceration.

With medium currents more actively congesting, softening, nutritive, osmotic, and electrolytic.

With strong currents, liquefying, hemorrhagic, escharotic, leaving a soft pink scar. High-intensity, cauterizing currents break down indurations, and cause gross destruction of tissues.

Positive local polar action with copper, zinc, silver and other bare metal attackable electrodes: Medium currents decompose and deposit oxychlorides of the metals within the tissues surrounding the positive electrode. The effects are antiseptic, germicidal, anti-hemorrhagic, drying, styptic, astringent, tonic, nutritional, alterative, curative of catarrhal inflammations of mucous membranes.

Negative local polar action with similar electrodes does not attack the metal, and, therefore, is limited to the properties of the current alone.

Other actions and refinements in effects which accompany or are produced by skilful technique and regulation of dosage are too complex for verbal description. Therapeutic actions which can easily be demonstrated are difficult to describe, for like harmonious sounds or shades of color they merge into the indefinite where language cannot follow them.

Having familiarized these effects and practised how to produce them, we are prepared to employ galvanic currents in clinical work.

CHAPTER VI.

CAUTERY APPARATUS.

Cautery Apparatus.—When the term cauterization is used in connection with medical applications of the galvanic current passing through tissues between two separate electrodes a chemical action is referred to which is entirely different from the *searing* process of a platinum knife, or wire, heated

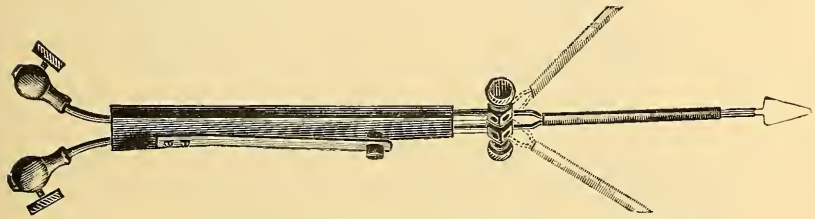


Fig. 11. Handle for holding cautery burners :—with interrupter.

to a cherry red or white heat, by a concentrated current with an amperage from 20 to 100 times greater than a medical dos-

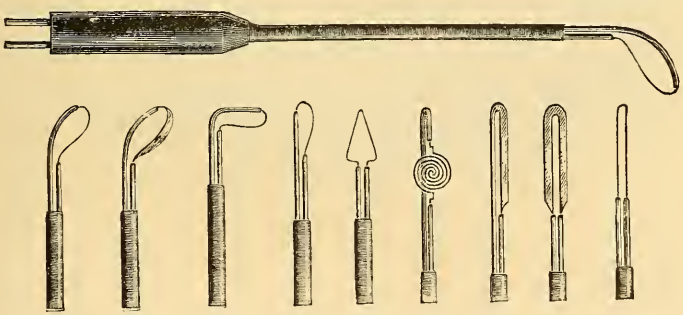


Fig. 12. Cautery burners flexible, for curving, etc.

age. In cautery work the electricity is not applied through tissues between two electrodes but is used to heat one electrode and to burn superficially.

Every physician must understand that the cautery battery is an entirely distinct apparatus from all medical forms. It embodies the principles of the ordinary galvanic battery, but is constructed in a special manner for the sole purpose of developing amperage, almost without voltage, so that the current will achieve the great object of supplying heat.

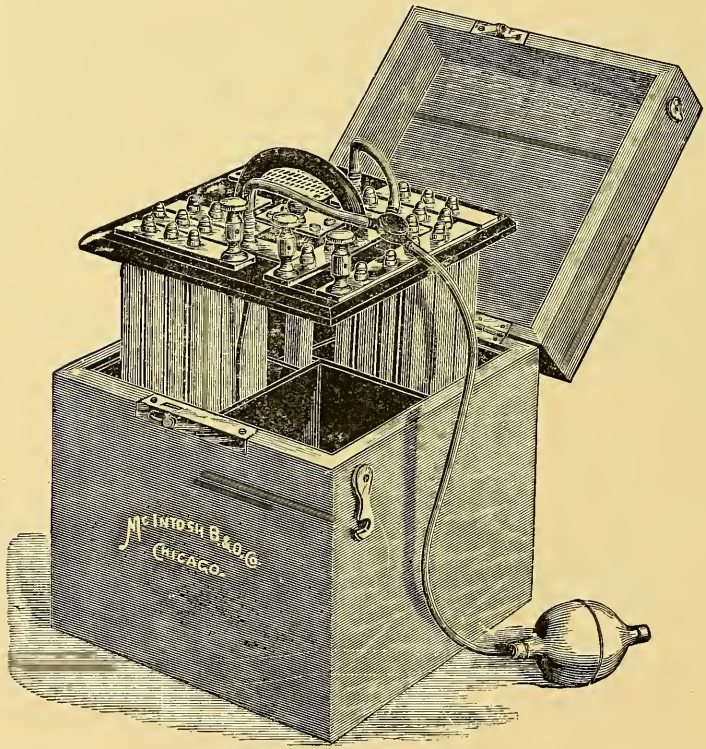


Fig. 13. Cautery battery.

An induction coil battery cannot be used for cautery work. An ordinary galvanic battery is not employed for cautery work, and a cautery battery is never employed for galvanic and faradic applications with electrodes in the ordinary manner.

By means of large elements connected in a manner somewhat different from the series connection of medical galvanic

cells, a small number of primary cells serves the purpose of a cautery battery. Secondary storage cells are employed for the same purpose when (rarely) it is convenient to do so, or by means of special controllers the street current is utilized to heat the cautery burners.

Physicians often inquire which is the best method to employ, or which is the best kind of a battery for cautery work.

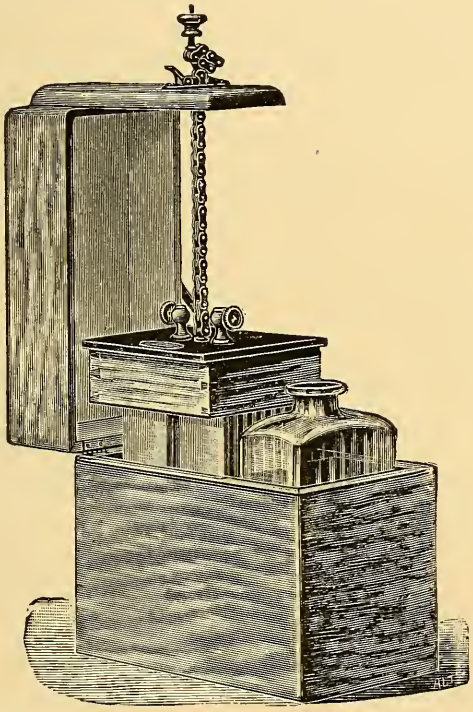


Fig. 14. A form of cautery battery for light work. (*Kidder. Mfg. Co.*)

Much dissatisfaction has also been expressed by those who have purchased cautery batteries from surgical instrument makers or small irregular dealers. I consider it unnecessary to refer to text-books for advice on such points. The best information can be obtained by examining the apparatus of the best makers. There are several long established and reliable manufacturers who devote themselves especially to

electrical apparatus for medical and surgical use. They are much better authorities to consult than jobbers in other goods, and up-to-date information can be obtained from them at all times. Improvements are gradually taking place in the construction of primary cell apparatus and in controllers for using the street current, and full particulars can always be obtained from the leading manufacturers. While the author is perfectly impartial in all matters relating to the commercial side of electro-therapeutics, yet it must candidly be said that it is an unwise policy for physicians to attempt to buy electrical apparatus from dealers who are in a miscellaneous business. Batteries with unknown names attached to them are often disappointing. High efficiency apparatus can best be obtained from houses who not only devote their entire attention to this branch of manfacture, but *who have for many years derived the advantage of consultation and advice from the leading workers in the field of electro-therapeutics.*

Commercial electrical dealers obviously lack this important advantage in the construction of medical apparatus.

CHAPTER VII.

THE ESSENTIALS OF FARADIC ELECTRO-PHYSICS.

The transforming device. Difference between galvanic and faradic currents. How to test "high tension" induction coil apparatus. Quality tests for faradic interrupters. The author's apparatus. Recording the dose of faradic currents.

The Essentials of Faradic Electro-Physics.—A single reading of summarized facts about faradic batteries will inform the practitioner on essential points.

"Faradic" currents are the product of mechanical devices which transform the direct electrical output of chemical cells. They involve the process called *induction*. An induced current of electricity is generated in a closed wire circuit placed near to, but not in contact with, another circuit through which a current is passing.

The continuous electrical current, now named in honor of Galvani, is directly conducted from the generating battery cells to the electrodes applied to the patient, without first passing through any mechanical device which modifies its character and action.

The mechanism of a galvanic battery has already been described. Let us now note the difference in mechanism which is required to modify the primary cell current so as to transform its character, action, voltage, and amperage.

We take one, two, or more of the same primary cells and simply divert their electrical out-flow to, and through, a device upon the switchboard of the apparatus before we conduct it beyond the apparatus to the patient. This mechanical device alters the direct galvanic into a faradic induced current, and the galvanic battery into a faradic battery.

It consists of two essential parts: an induction coil and an interrupter. In their commonest forms both are familiar objects to all who have ever seen a "family battery," but to possess therapeutic value they must be quite a different matter as respects construction and quality.

In a faradic apparatus the primary cell current passes along a conducting wire to, and through, the coil of copper wire wound spirally around the bundle of iron rods which constitutes the magnetizable core of the primary induction coil. From the moment the primary current is modified by this primary coil, it ceases to be a galvanic current and becomes an induction current. The distinction between these two cannot be too clearly understood, and it is referred to in a previous chapter.

Meanwhile a second conducting wire from the opposite element of the cell conveys the current to the second component part of the faradic transformer, which is the interrupter. This is usually of the spring vibrator type, which is too familiar to need description.

The head of the free end of the spring approaches the attracting end of the magnetized iron core in front of it when the current acts through the coil. The reverse surface of the spring presses against the stationary platinum point when the current stops and the magnetic core ceases to attract. There can therefore be no faradic type of current without the succession of "makes and breaks" set up by this method, and this constitutes one important difference between coil and cell currents. This interruption is accomplished automatically in medical batteries through the operation of the law of electric attraction and repulsion. "Like poles repel and opposite poles attract each other."

However, the device must do more than merely "interrupt" to transform a galvanic current into an induction coil current, for the primary cell current is often employed in treatment with an interrupter in the circuit without losing its galvanic characteristics of very small voltage and comparatively large amperage. What the coil does is to practically transpose these

relations of voltage and amperage. The current comes out of the first coil with much higher E. M. F. than it went in, and with its amperage reduced to a very small value; and when a second induction coil is placed over the primary coil the second inductive process carries the current to a still greater height of voltage, and proportionately attenuates the current volume.

The degrees of alternation by different coils are regulated for medical purposes by varying the diameter and length of the wire employed, and by making a greater or less number of

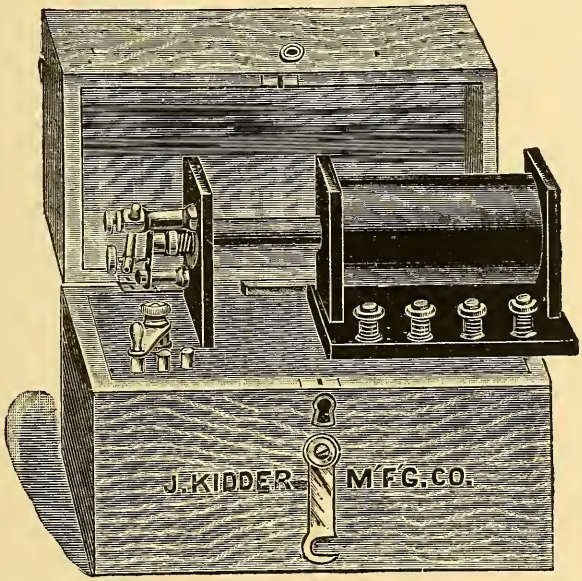


Fig. 15, represents a single vibrator faradic battery of low price for external applications. It is not designed for fine and sedative applications, but is equal to any battery below the high grade. It has an excellent coil of 4500 No. 32 wire tapped in three places.

turns in winding. The aggregate of these turns in the compound coil of the author's apparatus is above 15,000.

While all galvanic currents of equal voltage and amperage are alike in quality and therapeutic action, regardless of the particular style of apparatus from whence they are derived, the

same is not true of faradic currents. Induction coil currents not only depend for their best qualities upon the best apparatus, but are only obtained when the apparatus is in proper working condition and adjustment. It is important to recognize the fact that there is no standard of high-efficiency current common to all faradic batteries. All single coil, single vibrator, and single cell, faradic batteries (of which there are thousands in popular use) belong to a class of *low efficiency* appliances *altogether outside the sphere of genuine electro-therapeutics.*

A medium grade of faradic batteries, ranging between about twenty and forty dollars in cost, will perform satisfactory therapeutic work of a limited variety and chiefly for gross effects upon the external surface of the body. It is only when we go a little beyond this limit of cost and procure a high efficiency apparatus equipped with compound coil, ample E. M. F., finely adjustable rapid and slow vibrators, rheostats for current control in both primary and secondary circuits, pole changer, and switches for the simple, convenient, and rapid adjustment of all gradations of different dosage, that we secure the means of obtaining the best results throughout the whole range of modern faradic therapeutics. With a little care and attention to adjustment such an apparatus is always in working order for every form of application in either general or special practice.

How to Test High Tension Induction Coil Apparatus.—Since the discovery, chiefly made known within the past few years, of the important therapeutic effects dependent upon the quality in induction coil currents which is called "high tension," the ordinary forms of coils long furnished with common faradic batteries have become obsolete. Their field of action is limited to less than one-fifth of the therapeutic work of the improved apparatus, and they are wholly unsuited to the treatment of pelvic diseases, which constitute now the most important localized field in which coil currents are employed. Separate apparatus for coarse external work and the

finer needs of the gynecologist are not required, for the best apparatus does all varieties of work.

The term *high-tension* is merely a conventional one applied to induction coil currents which possess a very small amperage and a much higher voltage than ordinary coil currents. Fine wire wound with many turns producing high potential and low amperage are the special features of these coils.

The three factors which produce the special sensory, vasomotor, and motor effects of the modern improved faradic apparatus are high potential, low amperage, and rapid, smooth interruption at the rate of from 15 to 30,000 periods per minute.

With one such apparatus at hand no other kind of faradic battery is needed for any work which coil currents can perform, for the greater includes the less, and the scientifically constructed coil displaces all former and crude varieties. Even the best apparatus is now quite inexpensive.

Every physician may determine, to his own satisfaction, whether the apparatus he possesses fulfils the requirements of therapeutic coils.

Select a moderate size Geissler vacuum tube, about three or four inches long, which can be bought of dealers for less than one dollar. Connect the two terminals to the opposite poles of the faradic battery by any short pieces of copper wire. Start the current into action with either the rapid or slow vibrator. If the coil is one of the ordinary type the full E. M. F. of all the cells will produce no luminosity in the tube. This test should be made in a darkened room. If the longest and finest coil in the apparatus fails to glow the tube with the greatest E. M. F. of the battery, it is proof that the quality which is called high tension (or high potential) is not contained in the current of the coil so tested.

If, however, the coil contains sufficient fine wire to produce the resistance which creates high potential, and is properly wound and constructed, the tube will glow during the passage of the current. At least 4,500 feet of No. 32 or 36 wire ap-

pears to be necessary to glow a tube. The higher the potential of the current the brighter the luminosity. With the full length of the compound Kidder coil (containing nearly 8,000 feet of wire with over 15,000 windings) we obtain a very beautiful effect within the Geissler tube, and each coil is standardized by this means by the makers.

When the potential of the coil is carried immensely higher

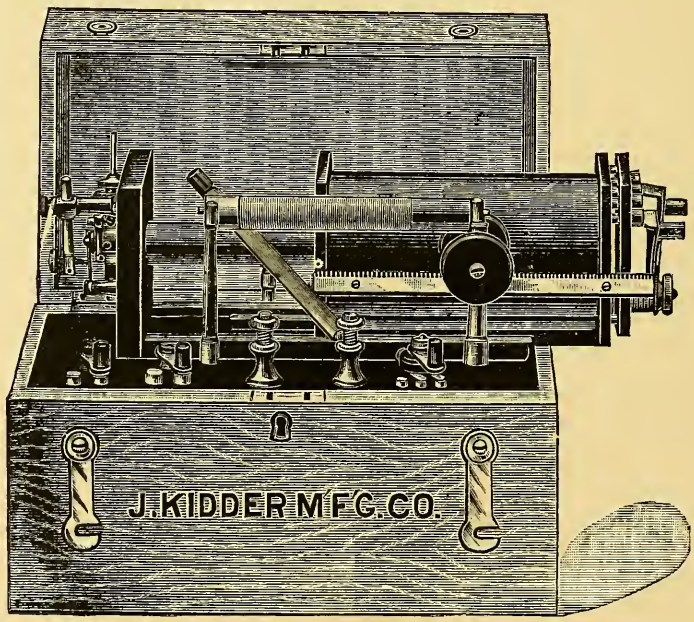


Fig. 16.
A high tension compound coil apparatus with primary circuit rheostat.
(J. Kidder Mfg. Co.)

by using a large amount of wire—far more than medical coils contain—we have the means of exciting Crookes tubes and producing X rays. The only reason medical coils will not glow Crookes tubes is lack of sufficient potential to complete the circuit through the resistance of the high vacuum. Geissler tubes possess a very low vacuum, as all physicians are aware.

Only Tests for Faradic Interrupters.—Refined therapeutic effects and the satisfactory use of rapidly interrupted high tension induction coil currents depend upon the constancy, evenness, and fineness of the vibrator action. It is essential to know what standard of quality a current should possess in these respects. Competent tests are afforded by eye, ear, and tactile sensation.

1. Geissler tube test. Connect the opposite electrodes of any small Geissler tube to the terminal posts of the battery by any short copper wires. Switch at least 4,500 feet of coil into the circuit, or better still, the entire length of the longest coil in the apparatus. Test the adjustment of the rapid vibrator with E. M. F. varying from one to four or more cells. Make the test with the tube in shadow or in a darkened room. If the vibrator action is uneven the fact will at once be apparent in the luminous effects through the tube. The wavy motion of the discs will be irregular and jerky. When the proper adjustment is finally made the vibratory motion of the discs will be regular and constant.

2. Telephone test. Connect a telephone receiver to the terminals of the battery by a pair of the usual conducting cords. Place the receiver to the ear. Every combination of coils from the shortest to the longest (both primary and secondary) with every variation of E. M. F. may quickly be tested by this method. Irregularities of vibrator action which the most expert operator could not detect by ordinary observation, are apparent to the ear through the telephone receiver.

3. Bipolar test. Connect the bipolar electrode to the terminals of the battery in the usual manner. For very fine tests with exceedingly mild E. M. F. let the tips of one finger rest lightly upon each metallic half of the electrode. With larger currents grasp the electrode closely in the palm of the hand. Any harshness, rasping, or irregular quality of the current will be made apparent to tactile sensation by the use of this method.

By means of any of these tests, the physician can compare correct action with improper action, and regulate the interrupter to its maximum of smoothness and rapidity.

A Satisfactory Faradic Battery for Physicians' use.—More faradic batteries are in the hands of physicians and the laity than all other forms of electrical apparatus combined. This is due, in part, to the few cells required, to the supposed "harmlessness" of the faradic current, and to the earlier and erroneous teachings that about 80% of electro-therapeutic work could be done with this type of battery.

An immense proportion of these batteries were never worth anything for medical uses. A large number of others are now as obsolete from age as a bicycle of ten years ago. Improved high tension induction coil (faradic) batteries are in the hands of very few men at the present date, and no physician who does not possess such an apparatus can write of faradic currents or teach their uses from the standpoint of the one who does.

Prominent authors have stated within a very few years that no satisfactory faradic battery was made. One writer has put on record his opinion that no satisfactory faradic battery ever will be made. As a matter of fact, a high efficiency and satisfactory, practical, and easily operated induction coil apparatus can now be bought by any physician for a sum but little greater than that paid for batteries of the kind which have been condemned by every competent expert in the uses of induction currents.

A so-called cheap faradic battery is therefore a wasteful investment, not economical even for the beginner, and injudicious for the practical physician.

The finer therapeutic properties of coil currents are dependent upon superior mechanism, and non-medical batteries do not possess the essential mechanism. There is about the same difference in quality between the family battery and a scientific medical battery that there is between the cutting edge of an iron blade and a razor of tempered steel. When this

fact is recognized by all physicians, the clinical results they obtain will be improved accordingly.

A medium grade faradic battery, with one or two medium

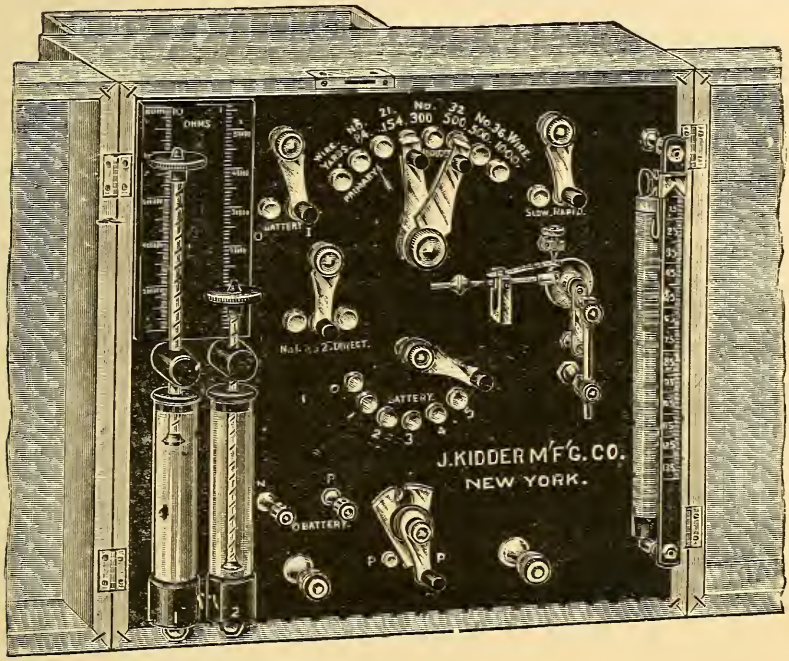


Fig. 17, represents the Author's High-Tension Induction Apparatus. This improved therapeutic apparatus embodies the following features: An upright switch-board with posterior invisible compound induction coil, approximating 8,000 feet of 36, 32, and 21 wire coils, permanently fixed over the primary helix, the author's original secondary current controllers and primary rheostat; the author's method of dose measurement, an interior battery of six dry cells; also rapid and slow interrupters, pole reverser, adjustable magnetic field switches, etc. A complete description of this apparatus, written by the author, was published in the *Times and Register*, August 25th, 1894; and an account of the method of dose measurement appeared in the New York *Medical Record*, December 21st, 1895.

coils, a single and non-adjustable vibrator, and perhaps two cells, may be bought for $20 or $30, and with it some of the coarser external applications may be made; but it is not neces-

sary to purchase a cheap apparatus for crude work and a fine apparatus for fine work, for a single practical and well-constructed induction coil apparatus will cover the whole range of faradic therapeutics from general faradization to vaginal and intra-uterine methods. No other type of faradic battery will then be required.

In 1893, I began the experiments which resulted in the production of an extremely satisfactory and by no means costly induction coil apparatus, since made and sold by the J. Kidder Mfg. Co., 820 Broadway, New York City. (Fig. 17.)

The upright switchboard of the author's apparatus presents a plain vertical surface to the operator without any visible faradic coil. It was designed by me with a view to placing in the specialist's hands, and in the hands of the educated general practitioner, an effective portable apparatus which would be entirely dissociated in the patient's mind from the frequently discredited ordinary coil batteries in common use.

The switches are all exceedingly simple to operate, and may be managed with equal convenience by either the right or left hand. Six dry cells are fitted in the portable case, giving a great range of E. M. F., and any desired number of these cells may be switched into circuit on the switchboard.

The coil and current controlling devices in this battery are unique and practical. Behind the switchboard is a high tension compound Kidder coil, with the entire set of secondary coils fixed permanently over the primary coil, so that no sliding back and forth is required. These coils combine nearly 8,000 feet of wire of assorted sizes, making upwards of 15,000 windings, tapped at approved lengths. By adjusting the switch arms connected with the coil the operator can produce twenty-one combinations in the secondary circuit, and can also unite the primary coil with any of the secondary coils. The simplicity of the arrangement is a decided advantage over a series of separate spools operated by the old-fashioned sledge or plunger methods.

The primary circuit rheostat controls the E. M. F. from the

cells. The secondary rheostat controls the current in circuit with the patient, entirely independent of the cells in use.

This apparatus was not only the first to employ a secondary current controller independent of the primary, but is still the only battery provided with the author's rheostat.

Regulation of Current Strength.—All methods of regulating faradic dosage, except through a secondary current rheostat, are incomplete and unscientific. Plungers and sledge

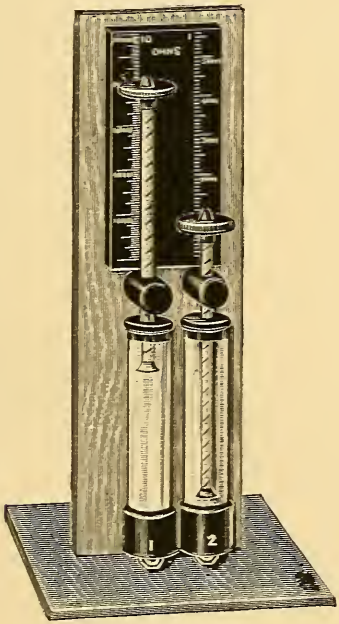


Fig. 18 Rheostat.

arrangements not only add a detail to technique which demands the attention of the operator but the therapeutic qualities of any secondary coil are not fully developed until its entire length overlaps the primary. If a fixed number of cells is used and the strength of the current reduced by advancing the secondary coil, only part of its length it is shorn of its best qualities and is improperly employed.

If an excessive E. M. F. is cut down by a rheostat in the

cell circuit the vibrator is deprived of part of its actuating force, and may become irregular or stop.

The problem of satisfactory control was solved by the author in the rheostat devised in the early part of 1894.

This rheostat, which is the peculiar novelty introduced in my high-tension induction apparatus, consists of two glass tubes marked one and two. They contain compound fluids, one of high and the other of low resistance. The resistance of the first tube is practically 1,000,000 ohms, and is sufficient to control the full coil, high tension current, and reduce the perception of it to zero in the most delicate application to a patient.

The second tube possesses a much lower resistance (55,000 ohms) for currents of less potential and for gynecological uses. The fluid in either tube, selected at will by a switch, regulates the dosage by means of an adjustable rod regulated at different heights of the column.

The resistance of each tube was measured in the physical laboratory of Columbia College, New York City, for the purpose of employing the scale of this standardized rheostat in making a record of clinical treatment.

Not only has abundant experience confirmed the practical utility of this rheostat as first described by me in the "Medical Record" of December 21, 1895, but the following letter, written at the close of some three months of experimental work, leaves little more to say upon the subject:

"NEW YORK, December 17, 1894.

"Dr. S. H. Monell.—Dear Sir: I return herewith the two tubes containing liquid resistances which you submitted to me. I have calibrated each tube and provided it with a scale which shows its electrical resistance in ohms for every position of the movable electrode. My opinion in regard to these devices is as follows: 1. A liquid resistance is a very simple and convenient means of obtaining very high resistance for medical use. 2. By changing the liquid the range of resistance may be varied from several megohms to a fraction of an ohm. 3. The screw adjustment of the electrode enables the

resistance to be gradually varied to any value, without the sudden shock which occurs when resistance coils are cut out. 4. The resistance is non-inductive, hence there is no reaction against or distortion of the current, which is very important in connection with induction (faradic) coils. 5. A short circuit cannot occur, the electrodes being arranged so that it is impossible for them to come in contact, whereas there is serious danger of short circuit in resistance coils with high-tension currents. 6. The resistance is practically definite and constant, provided the temperature remains nearly the same. With the small currents ordinarily used the heating effect is small. 7. The effects of polarization and electrolysis are insignificant, since the potential is high and the current is alternating in the case of induction-coils, with which these resistances are to be used. 8. The liquid does not appear to be affected by the action, or to change in any way, but it is of course impossible without actual trial to tell what effect might occur in a long period of time. Any difficulty of this kind might be overcome by renewing the liquid occasionally.

"Yours truly,

"F. B. CROCKER,

"Professor of Electrical Engineering,

Columbia College."

Slow Vibrator.—Every faradic apparatus for proper medical work must of necessity contain an automatic slow interrupter which will permit a regulation of the rate from between sixty and one hundred periods per minute up to a couple of thousand. The major part of muscle-contracting applications call for a rate of about one hundred per minute, although no exact number or count of periods is required. Few of the common faradic batteries contain such a vibrator. Some contain a slow interrupter which is affected by variations in the primary E. M. F., and is therefore not capable of satisfactory adjustment except at the sacrifice of the action of the coil.

In the apparatus designed by me this very important device is not only adjusted independently of the strength of current which reaches the patient but is thrown into action by the movement of a single switch. The change from the rapid to the slow vibrator can be made without any of the seven or

eight changes required with separate coil batteries, and is instantaneously accomplished by one movement of the finger.

The Rapid Vibrator.—One of the chief defects of common faradic batteries is the coarse and inadequate means of interrupting the current. The crude vibrator is neither *fast* nor *slow*, cannot be finely adjusted, and would destroy the therapeutic qualities of the entire apparatus, even if the coil was of a superior make.

Different types of rapid interrupters have been tested during past years. The question of a satisfactory interrupter cannot be settled when the clinical dosage is regulated solely in the primary circuit. The spring vibrator has come nearest to illustrating the survival of the fittest, but if the spring vibrator is crudely made it acts very poorly. When it is finely made and the parts kept brightly polished and adjusted it is eminently satisfactory. By a simple mechanical suggestion, derived from my experience with the static machine, I have secured upon my own induction coil apparatus a rapid vibrator which possesses the following qualities:

It can readily be kept bright and adjusted, and when this is done it starts into action the instant any one or more cells is switched into circuit. It requires none of the usual assistance in starting.

It very rarely stops during treatment until the current is stopped by the operator. Its action is exceedingly fine, smooth, and constant.

It holds its rate and smoothness without alteration during treatment, because the driving force in the primary circuit is wholly independent of the dose regulation in the secondary circuit.

For the same reason it is not affected by the manipulation of electrodes, the regulation of the dose, or any accidental jarring of the floor or table on which it stands. For the same reason also it holds its adjustment during continuous action, and the entire battery does not demand five minutes' care per day to keep it in running order.

The slight sound made by the vibrator is so unobtrusive that it is scarcely perceptible to the patient, and never annoys the most delicate ear.

Rates of Interruption.—Almost all variations in practical clinical work are sufficiently indicated by the terms *rapid* and *slow*. The term *rapid* throughout this book is applied only to the *most rapid action* obtainable with the best type of spring vibrator. It is immaterial in clinical practice whether this rate is exactly any number of thousand periods per minute. The number of vibrations represented by the musical note C which at one time figured largely in electro-therapeutic writings has no practical bearing on the subject.

The medium rate of common vibrators on cheap batteries is not sufficiently rapid to produce the effects desired in sedative applications, and is far too fast for the muscle effects of slowly interrupted currents. Such a vibrator is therefore limited in range and almost useless.

The so-called singing rheotome introduced several years ago was not satisfactory.

To those who desire to demonstrate the differences in physiological effect of varying rates of interruption, the static machine affords an impromptu means of making tests. It is difficult, if not impossible, to construct a faradic device which can be adjusted at will to give every known rate of interruption from, for instance, one to a million per minute, but to accomplish this with the static is no trouble at all. It is only necessary to turn the machine slowly or rapidly and hold near the positive conductor a grounded ball electrode. Its range of action cannot be excelled, for I can shift it to any degree of proximity between actual contact and a full sparking limit, say six inches. We can thus demonstrate that an excess of rapidity in breaking the current will thwart the purpose for which breaks are made, and that a moderate interval is required between the discharges to produce perceptible effects. As a handy object lesson, it is worth many pages of theory upon the subject.

Care of the Author's Induction Coil Apparatus.—The bright parts of the switchboard, which require occasional cleaning or polishing, are removable, as are also the tubes of the fluid rheostat. When, after some use, the platinum tips and interrupters become oxidized, they should be unscrewed and polished with a little sapolio on a small piece of moistened cloth, or with a jeweler's buff, but never scraped with a knife, as is commonly done. *The more carefully the vibrators are kept bright and free from tarnish, the more satisfactorily they will work. Whenever a black spot forms under the platinum ball, clean it off, even if it has to be done every day, and the rheotome will then perform its duty faithfully. If the interrupter loses its spontaneity of action, look for oxidation and remove it by polishing both ball and spring.*

Operative Facility.—No feature of the author's improved type of faradic battery gives greater satisfaction to the physician than the facility with which all changes in the current may be made without startling or annoying the patient.

If it is desired to substitute a shorter and coarser coil (or any other secondary coil) for one of different length and size, or to switch additional cells into circuit, or to reverse the polarity, or in fact make almost any desired change in the technique or dose, it may be made at will without withdrawing any spool or searching for another coil, or stopping the battery to begin again from zero; and should the vibrator occasionally stop during treatment it can be set going again without startling the patient.

In batteries depending upon the sledge coil or primary rheostat for regulation of current strength all sudden fluctuations must be carefully avoided. They are liable to cause the patient a greater or less degree of shock, and unless due caution is observed in treatment the patient acquires a nervous dread of having the battery "meddled with" during an application. This destroys her comfort and impairs the benefit.

These objections are obviated in my apparatus by the action of the useful secondary rheostat. This takes up the excess

force of sudden fluctuations and protects the patient. If the change is one which decreases the dose it will cause no sensation whatever. If it increases the dose only the normal increase will be felt and no startling surprise to the patient will accompany the change. It can be made entirely imperceptible by first raising the secondary rheostat a trifle.

Among other practical features of the switchboard are switches to reverse the positive and negative pole at will during treatment, and to select for use either one of three graduated current controllers, and any desired amount of E. M. F. from one up to six cells. The primary rheostat may be partly or wholly switched out of circuit as may be desired, and the secondary rheostats can also be cut out of circuit and the entire regulation be made through the primary.

Both the rapid and slow interrupters are operated by a single magnetic field which is adjustable to any relation with either rapid or slow vibrator.

The absence of separate coils to shift, exchange, or slide on runners relieves the operator of detail and removes a prolific source of nervous dread to the patient. By means of a compound switch the physician instantly selects the size and length of coil desired. The portable dry cells can be removed from the case and new ones inserted by the physician without sending to the factory. Terminal posts upon the switchboard may be connected with outside fluid cells if the operator prefers to use them in his office work.

The apparatus is inclosed in a handsome mahogany case and is easily portable about an office, although somewhat heavy to carry a distance. Without, however, lessening its effective appearance it may be lightened for outside practice by stating the requirements to the makers. It is constructed for all-round work, but may be adapted to special practice by omitting any part of the series of coils or cells which are not needed for limited applications.

Quality of faradic currents from the author's improved high tension induction coil apparatus.—No part of the lit-

erature of electro-therapeutics is now so unreliable for the guidance of the general practitioner as that pertaining to what are called faradic currents. Teachings upon this subject by those who employed the commoner forms of faradic batteries which were practically the only ones available ten years ago, and are still in too common use, are obsolete for the instruction of the practitioner to-day.

Statements made by leading and original observers (even including Tripier and Apostoli and some of the best teachers in the field in this country) are also misleading, for they are based upon clinical work with apparatus quite inferior to the best now obtainable. I do not recall more than two or three authoritative writers who have enjoyed the advantage of speaking from practical experience with high efficiency induction coil apparatus. I have never seen a text-book on general medicine or nervous diseases which did not refer simply to inferior faradic batteries which we no longer use.

In references to pain said to be caused by faradic currents, and the action of such currents upon pelvic inflammatory processes, almost all the outstanding literature is either more or less misleading or decidedly obsolete.

On the other hand the physician may turn from the crude and jerky current with which his imperfect battery has made him familiar and read of so-called sinusoidal machines which produce "painless currents and remarkable effects." He may read that the sensations produced by the application of this instrument differ radically from those which result from the employment of an *ordinary* faradic coil. "They are much softer and more agreeable. They produce painless muscular contractions, abolish pain in painful diseases, stimulate the nerves of special sense, and actively promote the metabolic processes."

It is entirely correct to say that these effects are beyond the capabilities of the family battery, but they are entirely within the ordinary capabilities of improved induction coil apparatus such as I have employed for the past three years. It is only

because the reader associates "faradic" currents with *inferior* faradic batteries that he is attracted by the apparent superiority of a strange and unfamiliar device. The author's improved induction coil apparatus produces a greater variety of currents, and is not only portable and less expensive, but is simpler in operation and therapeutically more efficient. The past statements of writers have been chiefly made without taking into account the superior type of faradic battery, and it will be observed that comparisons of the two currents, the alternating and the faradic, are always made with reference to the kind of faradic batteries not employed in fine therapeutic work.

Not only does my apparatus produce the "even and smooth sensation," described above, the "muscular contractions of great vigor without pain," the "luminous effects upon the optic nerve," but also with the positive electrode upon the back of the neck and the negative upon the abdomen it will stimulate the gustatory nerve and produce the well known metallic taste so familiarly associated with galvanic action.

Recording the Dose of Faradic Currents.—The secondary circuit fluid rheostats of the author's apparatus constitute a practical basis for approximating and recording the therapeutic dose of the induction currents employed.

A faradic meter or measuring instrument similar to the familiar galvanic meter has never been made, and owing to the qualities imparted to coil currents by variations in voltage, amperage, and rates of interruption the idea of such an instrument pertains only to the realm of theory. It is not practicable.

No actual meter is required by the operator in regulating the current strength to produce desired effects, but all who trace the work of investigators through the literature of the past fifty years must admit that the words *faradism* and *faradization* tell the doctor nothing about the dose or method of application. No one who studies existing text-books for aid to the treatment of a patient can fail to wish that there was a standard method of reporting the essential facts relating to

treatment so that others could employ the same method and procure equally good results.

Quite a good deal has been written about the dose measurement of faradic currents, and, for the purpose of establishing correctly the exact nature of the measuring problem in the reader's mind, I shall cite the following extract from my article on this subject published in the *Medical Record*, Dec. 21, 1895; and *Medical Times* and *Register*, Aug. 25, 1894:

A group of contemporary statements upon the subject of faradic dosage will be recognized by all familiar with the literature of electro-therapeutics.

1. "A bar to the progress of faradism is the impossibility of satisfactory therapeutic measurement. Edelmann's faradimeter is incomplete and, I must even add, misleading as a physiological or therapeutic measure."

2. "The Edelmann faradimeter, which is not by any means, as was intended, a measure of faradic electricity, is too complicated and expensive for the practitioner, . . . and is merely a deceptive snare for physiological or therapeutic purposes. *The strength of the current would be far better approximated by indicating the nature of the coil and the resistance offered than by the volt scale of this faradimeter.*"

3. "Unfortunately we have no means of measuring accurately the dose of faradism, the only means at our command being the millimetre scale placed at the side of the coils. This is a very rude method, indeed, but it is all we have at present."

4. "It is much to be regretted that we have no means of accurately measuring the therapeutic dosage of the faradic current."

5. "The old attempt to measure the faradic dose by a coil movable over a primary core, on a graduated scale, was so unscientific and inadequate as to be ridiculous."

6. "It is the ability to record the doses of the current to which must be ascribed the rapid progress of galvanism. To give the necessary impetus to faradism, we must obtain this same precision, . . . and toward this end my efforts have been directed ever since I realized how seriously this valuable remedy was affected by its vagueness and uncertainty; and as early as 1886 I sought to approximate dosage by a defining and precising of details."

7. "The precise measurement of the faradic current for therapeutic purposes has not as yet been satisfactorily attained. The method heretofore in vogue, of measuring on a scale the

distance the secondary coil is advanced over the primary, is inaccurate and delusive—in fact, means nothing—since the battery current varies with use; and no estimate is taken of the variable resistance encountered in the external circuit, which is altered by the location of the electrodes, by their size, and by the distance between them. The fact that this current possesses the same two qualities as the galvanic current —pressure and volume—makes it evident that we must in some manner estimate the relative voltage and amperage of the current employed in order to arrive at a practical conclusion of its comparative value."

The striking remark which closes the second comment cited above, although not observed by the writer previous to the preparation of this article, foreshadows what is substantially accomplished by the method to be described in this paper, and which was originated by me, January 29, 1894. My method also takes into account what is suggested as necessary in comment number seven, but before proceeding with descriptive details, certain relative facts require to be understood. These are as follows: No automatic meter or measuring instrument is required to select the proper dose of faradism for a patient, or to adjust it to the needs of therapeutic use. Direct currents need such an indicator, but induced currents do not. The educated skill of the operator regulates the dose, and does it adequately. The existing need is for a standard system of recording the treatment administered, and thus impart uniform value to the reports of clinical cases, and introduce precision and definiteness into the special literature of the subject. My method does this.

The accepted dose measurer of the constant current is the milliampèremeter, adopted universally within half a decade, and which in general estimation has lifted the galvanic current from empiricism and placed its therapeutics on a scientific basis. Let us, therefore, note exactly what the milliampèremeter accomplishes and what part it plays in the dose record, in order that we may better understand the problem before us in attempting to measure and record the dose of induction currents.

To enable separate observers to compare and repeat results in clinical cases treated by galvanic current, we should take into account every factor which affects the action of the current. A comprehensive record must necessarily inform us then, on the following points: 1. Surface area or types of electrodes—which range from needles, sounds, tips, etc., to small or large pads, or water-baths, or may be clay, copper, zinc, carbon, platinum, steel, tin, brass; or covered with

sponge, cotton, felt, etc., determining conducting power and density of the current. 2. Situation of both positive and negative electrodes during treatment. 3. Tissues treated and their pathological state, symptomatic conditions, etc. 4. Time and frequency of administration. 5. Reading of the milliamperemeter, or current volume.

Clinical reports of these particulars, with results of treatment, would be complete; and while of the various factors the meter furnishes but one, it supplies the last essential to the dosage of galvanism.

When we enter upon the problem of faradic dosage, we find the factors no fewer, but differing in character. These are now: 1. Character of the current, as determined by the coil employed. 2. Description of electrodes and their situation during treatment. 3. Rate of current interruption. 4. Tissues treated, condition, etc. 5. Current strength. 6. Time and frequency of application.

The missing link in our clinical record is a means to state the current strength. We can sufficiently indicate the rest. How shall we measure the current strength? Now, certain features enter into the measurement of a constant current which are eliminated from the case of an interrupted or alternating current. The therapeutic requirements of the two are inherently dissimilar. The galvanic current is silent in its flow and physiological activity. Without observing the deflection of the meter needle, or making other test, we may be in doubt whether or not the battery is in action until the current is strong enough to be felt by the patient, and as a guide to treatment the patient's sensations are incompetent. The predominating quality of the direct current is volume—its voltage being relatively small in medical uses—and "volume" cannot be determined by the eye or ear of the operator. On the other hand, the induction apparatus, through its break-piece, which is the essential, the very life of this form of electricity, gives forth to the ear and sight unmistakable evidence of action; and its current is one of predominating force, of insignificant volume, chiefly mechanical in its physiological effects, and nearly devoid of chemical properties. It therefore requires no peculiar safeguard, like the milliampèremeter, against an excess of electrolytic or cautery action within the tissues. Moreover, owing to the feeble power of dissociation possessed by the constant current, an enormous range of uncertainty enters into every galvanic application without a meter in the circuit; for the actual current strength—*i. e.*, dose—from the same number of cells and with the same electrodes will vary greatly with the degree of resistance of

the skin, etc., so that similar conditions of E. M. F. are no guide whatever to similar doses and effects. With the galvanic current, with either 5, 10, 20 or 40 cells E. M. F., and with the electrodes in a glass of water, I can cause the meter to vary from 2 to 250 milliampères, without altering the electrodes or the battery, simply by lessening the resistance of the water.

The nature of the induction current, however, is such that little of this great variability occurs in clinical applications when similar conditions of treatment are repeated. A given E. M. F. will produce a definite current strength from a given induction coil, and repeat it under the same conditions as often as desired. The influence of slightly varying skin resistances of different parts of the surface of the body is insignificant in the case of the higher voltage and penetrating capacity of currents from induction-coil apparatus. We have, in fact, but two practical conditions of resistance to consider in faradic therapeutics, viz., the greater general resistance of the skin in external treatment, and the lesser resistance of the moist, mucous surfaces of the cavities of the body. Thus presented, we observe that the problem of faradic dose-measurement, or means of record, is much simpler than was that of the now solved problem of galvanic dose-measurement; for if we can by any means indicate the electrical or mechanical energy of our induced currents under conditions identical with their clinical administration we are assured of obtaining the same energy for therapeutic uses and repeating it upon patient after patient with substantial accuracy. A standard indicator of current strength will accordingly serve as a subsequent dose register for future applications from all similar apparatus, and although not a meter may serve as a substitute for purposes of record.

The methods so far suggested for measuring the dose of induction-coil currents are as follows:

1. A strip of suitable material, wood, celluloid, or vulcanite, is placed at the side of the coil and marked in fractions of inches, or of the decimal scale. The current increases in strength as the coil overlaps the primary, and the dosage is taken to be the extent of overlap during the *séance*. The capabilities of measurement are exhausted when the overlap is complete, and the record must be alike for one or four cells, or No. 36 or No. 16 wire coils. It is not surprising that this attempt to measure current strength by a foot-rule was never scientifically successful.

2. The graphic method of marking the current waves; a purely fanciful idea adapted for blackboard illustration of cer-

tain currents characterized by sufficient amperage to operate the tracing-pencil, but neither practicable outside of the expert's hands, nor capable of demonstration at all with the currents of higher tension and frequency, and consequently smaller amperage now performing so much of the therapeutic work of improved induction apparatus.

3. The Edelmann faradimeter. The name faradimeter is felicitous and suggestive of a proper method, but it has never reached a more practical stage of development for ordinary use than have ships for navigating the air. It is a complicated, expensive, though highly scientific, meter for the voltage of the current in the short circuit; and since therapeutic applications involve the interposition of body tissues this instrument has no relation whatever to a physiological unit.

4. Micro-coulombs were asserted to be the electrical unit by which to express faradic measurement, but when we turn to the coulombmeter for aid we are practically where the faradimeter left us. There is no need of any coulombmeter.

5. Voltmeters, ammeters, and wattmeters that fill successfully their proper places in measurements of large commercial currents, do not supply us with any means to meter the small currents of medical coils. If a miniature wattmeter could be made to work it would be too expensive for general use.

6. Rate of interruption. It is assumed that if this is stated in mathematical terms a certain amount of precision will be secured. Other factors, however, affect the question of dosage too materially to place dependence solely upon knowing the frequency of the periods.

This brings us to consideration of the substitute method proposed by me. The method was first made possible when I introduced my fluid current controllers into the secondary circuit. They easily supersede in value all previous methods of regulating current strength.

The switchboard of my induction apparatus presents a rapid interrupter (vibrations of 20,000 to 30,000 per minute); a slow vibrator capable of adjustment from about two thousand periods per minute down to less than one period per second; a cell selector throwing into circuit from one to six cells at will; an eight-button compound coil selector; a pole reverser and a metallic rheostat governing the primary current. This consists of a perpendicular column seven inches in height, wound with German-silver wire of definite resistance, making twenty turns to each inch of column. Attached to it is a registration scale to denote every wind of wire from zero to 140, and permit a record of position in every degree of use. This scale is

also an advance in accuracy of record, first suggested by me. But the peculiar novelty introduced in this apparatus is the author's secondary circuit rheostat, which consists of the glass tubes seen at the left of the switchboards and marked respectively 1 and 2. They contain prepared fluids of great resistance (much greater than water), and are the first competent controllers successfully applied to the secondary current of a medical induction battery. The capacity of the first (one megohm) is sufficient to control the full coil, high-tension current, and reduce the perception of it to zero in the most delicate external applications to a patient.

The second tube possesses a much lower resistance, for currents of less penetrative force. Each tube is scaled in ohms of their actual resistance, measured and calibrated for me by Professor F. B. Crocker, of Columbia College, New York. The rationale of my method is now extremely simple. The fluids in one or both tubes, and at certain heights of the movable contact rod, varying with the primary E. M. F. and current density, entirely nullify the patient's perception of the activity of the induced currents, *i. e.*, control them, and reduce their physiological and therapeutic manifestation to zero, and afterward regulate them to any strength we desire. What resistance to the energy of any given current does it require to do this? The answer to this question approximates the dosage in standardized apparatus.

The scale referring to tube No. 1 shows the total resistance of its four and a half inches of fluid column to be one megohm. As the movable electrode descends in the tube the resistance lessens until it is only 900, 800, 600, 400, 200 thousand ohms, and so on down to the minimum, when the electrodes of the rheostat are nearest contact. The great resistance of this tube is designed to regulate the higher tension currents of the compound coil, which, in this apparatus, I have caused to be placed invisibly behind the switchboard, and fixed in complete overlap upon the primary helix. This coil is immovable, and does away with former sledge methods of sliding coils on and off, while it generates at all times the maximum of inductive influence.

Tube No. 2 is of much lower resistance, ranging from 55,000 ohms down to a residual resistance of 4,000 ohms, and is suited to the regulation of currents of small voltage, from short, coarse coils, or other applications where great tolerance exists, as within the pelvis. An additional turn of a switch also cuts out these secondary rheostats, and furnishes all currents direct from the coils, in case this is desired. The metallic rheostat

in the primary circuit then regulates the strength by altering the E. M. F.

In applying a given current strength to a patient, the energy at first wholly expended within the secondary rheostat, when perception of the current is nullified on its passage through the rheostat to the patient, is released from the controlling rheostat to exert itself within the tissues when the descent of the movable rod in the tube reduces resistance proportionate to its descent. In other words, as the restraint of the current falls in the rheostat, its released energy rises in the patient, and by measuring the degree of restraint we find the equivalent of the released energy in the circuit.

"Things which are equal to the same thing are equal to each other," and knowing the graduated resistance in electrical units of ohms interposed and removed from the secondary circuit at will, our knowledge of Ohm's law substantially defines for us the values of therapeutic dosage. We have only to let a portion of the measured rheostat substitute itself for the patient's tissues while we at first regulate the degree of energy to employ, and next to record the same current value in resistance, to arrive at a very practical measure of the dose administered. The resistance of the body is compensated in the process, and causes no error, and the battery E. M. F. is unaltered during the dose regulation.

While, therefore, the once proposed scale of fractions of inches was a purely fictitious and ridiculous travesty upon scientific dose-measurement, the author's method is a comparative record of the current strength, and not a mere fragment of a tailor's yard-stick. As such a resistance register and rheostat is of general applicability, and may be placed by all instrument-makers upon high-grade batteries if properly standardized for clinical use, it may be fairly claimed that the general adoption of my method would supply the long-expressed need for precision in faradic dose records *until* the invention of a meter.

To illustrate the method let us hold, for example, two ordinary electrodes in the hands, select for our coil one thousand five hundred yards of No. 36 wire, and employ very slow interruptions of, say, seventy per minute. We raise the rod in tube 1 to its full height, and switch four cells into circuit. Gradually lowering the contact rod, we note the point where the current becomes first perceptible to sensation. It is at 700,000 ohms resistance on the scale. Taking this as our zero unit, we continue to lower the rod until muscular contractions are produced as strong as we desire. The rheostat now indicates but 100,000 ohms, showing that 600,000 ohms of resistance have been removed from the passage of the current into

our arm muscles, which respond to the force previously expended within the rheostat. If now I record the facts: Coil, 1,500 yards of No. 36 wire. Interruptions, 70. E. M. F., four cells. R. 600,000 ohms, small sponge electrodes in hands, positive in right; I can repeat the exact application and muscular effect whenever and as often as wished, even should the cells deteriorate by use so as to require five or six cells to equal the energy recorded. There is no parallel to this precision of record to be found in the literature of faradic electricity. The method allows for all possible variations in treatment.

Again using a short, coarse coil, one hundred and fifty-four yards No. 21 wire, for instance, we obtain sensation with a given contact at 36,000 ohms resistance of tube 2; and full tolerance is reached when but 4,000 ohms remain. The given dose is therefore the electrical energy represented in removing 32,000 ohms of resistance, with the current quantity value indicated by the capacity of the wire in the induction-coil. It is not essential to know the amperage with a corresponding voltage, for we are not dealing with galvanic, but with induced currents, in which volume is subordinate to potential and kinetic energy; and our different coils—long, medium, short, fine and coarse—take on a definite individual identity under habitual use, which serves the expert as a practical expression of their ampere values. Our second record reads with electrodes same as before, but a more rapid rate; coil, 154 yards No. 21; frequency, 300; cells, two; R., 32,000 ohms.

In making a vaginal bipolar application with a very rapidly interrupted high-tension sedative current we use tube 2, with its low resistance, owing to the enormous tolerance of the tissues treated.

An illustrative clinical record reads as follows: Vag. bipolar sedation, coil, 1500, No. 36. Rapid vibrator, E. M. F. 4 cells. R 45,000 ohms, twenty minutes, daily.

If this seems to express a small dose (an inadequate estimate of the great tolerance of the pelvic tissues), it must be remembered that it is the difference between zero sensation and the maximum current strength administered with electrodes applied in actual treatment, which is recorded as the dose, and not the difference between the sensitive nerve-filaments of the hand and tissues whose dullness of sensation and low resistance to current diffusion permits them to accept with comfort and benefit an application which would be painful on the surface of the skin. If the dose was reckoned from a zero obtained in one arbitrary manner, say, by touching the electrodes with the finger or thumb before applying them to the patient, it would

bear no genuine relation to the dosage of larger contact areas, of different varieties of electrodes and different parts of the body.

To be a scientific and universal method it must answer for all conditions of treatment, and my method does this perfectly. The use of a single cell, or of any number up to six (the battery contains six cells), will determine the zero at a higher and lower point on the scale, and the same cells, as they deteriorate, in time will alter their E. M. F.; but these variations do not alter the accuracy of my dose record, which is the difference between the minimum and maximum rheostat readings independent of the number of cells it takes to furnish the given inductive force.

The difference, also, in power to penetrate tissue resistance will create a different zero point for each length and size of wire, even with the same E. M. F. inducing force and same electrodes; but with standard coils, a standard method of finding the actual zero point in all cases, with any coil, with any number of the battery cells at any period of their life, my method furnishes a flexible, permanent, and accurate measurement of the true therapeutic dose. Its adaptability to varying conditions of current volume, voltage, resistance, and density removes all sources of error.

This method, carried out in its fullest detail, is particularly applicable to the records of clinicians and other observers whose investigations require an exact comparison of results. In general practice the physician will soon familiarize himself, at least approximately, with the position of the rheostat for various zero readings, just as the skilled book-keeper soon remembers the ledger pages of his accounts; so that actual tests for zero will be unnecessary except, perhaps, in the first treatment of a new case. If the full dose record is considered superfluous for the physician's own records in his ordinary office work, a modification will furnish satisfactory notes for personal reference. In using the modified method which I suggest, we need not repeatedly calculate the actual dose administered, but simply note the conditions under which the maximum current was applied by recording the lowest reading of the scale. For example: coil, 1000, No. 36. Rapid V.: cells 5; scale 6000; tube 2; vag. bipolar, 20 minutes. There is no expert electro-therapeutist equipped with similar apparatus, who, on reading this record, could not instantly apply the same treatment with substantially the same dose, though he were a thousand miles away. The use of initials for full words will, of course, abbreviate the record in private case-books and be equally intelligible to understanding.

Of the other factors requiring report for purposes of uniformity in clinical observations, the character of the electrodes can always be identified by sizes, numbers, or names, as in makers' catalogues. Quantity and quality, the elements of induced currents subordinate to their energy and pressure force, are, as we have seen, sufficiently expressed by reference to the particular coil employed. A more exact description will hardly be required by experts in electro-therapy. As the trained electrician becomes accustomed to the quantitative and qualitative differences in effect between every coil in his apparatus, whether 500, 1,000, or 1,500 yards of No. 36 wire, or 800 or 500 yards of No. 32 wire, down to shorter coils of No. 21 or 18 size, he accurately knows the characteristics of currents from them all, and utilizes their diverse properties with intelligence and precision.

It would add no therapeutic value to his knowledge if the current volume, per coil, was noted by a meter in terms of amperage, or the E. M. F. in volts.

There now remains but one factor of dosage still surrounded by vagueness and lack of precision in theory, although clearly enough defined for practical purposes. This relates to the record of the rate of current interruption, a very important part of the matter indeed. Very low rates (50 to 300) can, however be stated in comparative figures, while very rapid interruption does not require a numerical term to express its frequency. Speed, as stated in mere figures per minute, is so involved with other qualities of adjustment, evenness, constancy, length of period, amperage, etc., that the advantage of a mathematical record can be greatly overestimated.

I have referred to this in other of my writings, and, it is out of place to dwell on this point at present, though it is one of peculiar interest. A closely related feature, however, may claim our attention briefly.

It is the ideal of some who have sought to define faradic dosage by rate of interruption, and who have devoted much time and special thought to the improvement of faradic apparatus, to construct an independent interrupter, actuated by a current separate from that which supplies the inducing force.

The reason for this lies in the fact that every change in the regulation of current strength made in the primary circuit varies the rate and force of the interrupter in instruments as generally made. A prominent writer has ably argued the advantages of such method, and states that it can be adapted to every kind of contact-breaker, the motor power for the rheotome being furnished by a single separate cell. The im-

portance of steadfast E. M. F. and unvarying evenness of interruption throughout all gradations of the induced current strength, is so great, so essential to the satisfactory employment of faradic electricity, that no battery not providing for independent secondary current control can be considered as representing the advanced progress of to-day.

Manufacturers of medical batteries, however, do not all agree with the writer who advocates the separate cell for the interrupter, and are well-nigh unanimous in declaring that the mechanical obstacles to the device are insurmountable in practice. The theory is correct, but makers have failed to apply it successfully to the vibrators in common use. My apparatus easily surmounts the difficulty; furnishing not alone one cell to actuate the break-piece, but places six at our disposal at will, as independently as any theorist could desire. My former article describing the improved induction apparatus designed by me, referred to this feature at some length, but I wish to emphasize again the far-reaching importance of the secondary rheostats which accomplish this purpose in my battery, and to state further that, were their usefulness and influence restricted to mere regulation of induced current strength, without jarring or irregularity, or change in the primary flow, the advantage they would thus contribute to clinical handling of both patient and battery would alone stamp the apparatus as without an equal in therapeutic convenience and capabilities. That beyond this these rheostats make possible a practical dose record, is proof of their fundamental necessity to a perfect instrument. If still unconvinced that they are indispensable, let us attempt to adjust a slowly interrupted induced current—say fifty periods per minute—to a dosage of strength sufficient to produce powerful but painless, rhythmical, and non-tiring contractions of certain arm muscles, with a gradual and even decrease to scarcely perceptible sensation. With the ordinary interrupter, sliding coil, or primary rheostat, it cannot be done without altering the E. M. F. or affecting the vibrator rate, even with the costliest appliance in the market. With my apparatus it is done instantly and with the most striking success. As an object-lesson in the inadequacy of old methods of current regulation, and of the superior efficiency of my secondary rheostats, it leaves nothing open for argument.

Our next step will be the study of how we can utilize faradic currents in producing therapeutic effects.

CHAPTER VIII.

PHYSIOLOGICAL AND THERAPEUTIC ACTIONS OF INDUCTION COIL CURRENTS WITH RAPID AND SLOW INTERRUPTIONS.

Effects of different rates of interruption. Effects of rapidly interrupted high tension currents. Effects within the pelvis. Effects of different coils.

THE influences of faradic currents upon living tissues are those which result from different degrees of electro-mechanical energy combined with but a minimum of dynamic, chemical, or electrolytic action. Induction coil currents are allied to mechanical forces by their higher voltage, while their small amperage and intermitting activity deprives them of dynamic influences which depend upon a larger volume of continuous current flow.

Faradic currents may first be judged by considering separately the different effects of slow and rapid interruptions rather than of fine or coarse coils. It is true that the conductivity of copper wires increases with their diameter capacity, and a number 32 or 21 wire coil will carry greater amperage than a No. 36 wire coil; but E. M. F., potential and rate of "make and break" are factors which actively dominate the fractional amperage of coil currents.

When a slowly interrupted faradic current excites a motor nerve it causes a series of slow muscular contractions. When the interruptions are sufficiently rapid, and the current strength is adequate, a state of continuous tetanus is produced in the muscles through which the current passes.

Contractions will be most powerfully manifested at the negative electrode, in all variations of E. M. F., when both electrodes are of equal size and material; and the negative

pole is therefore said to be more stimulating than the positive. If the positive electrode is small and the negative large the positive will be the most "stimulating."

If the interruptions of any coil current are very slow—from fifty to one hundred per minute—the muscles have time to contract and relax with an interval of rest, so that very vigorous effects can be produced with neither pain nor fatigue. If the rapidity of the stimuli is increased to two or three hundred per minute, without in any way altering other factors of current strength, the muscles will not have time to relax and rest, and fatigue and distress will result and finally become intolerable. The dose must be immediately reduced or the muscles will be overworked and exhausted.

With a slowly interrupted current of moderate strength—a strength which can be regulated with mathematical precision to suit all cases, as will be explained elsewhere—we wish to exercise muscles beneficially and promote their function, nutrition, activity, endurance, and strength, which various causes may diminish.

The physiological effects of improving muscle function by slow, forcible, faradic contractions are so well understood by all physicians that they require no further comment. To obtain these benefits we usually employ a rate between seventy and one hundred and twenty-five periods per minute. With an improved high tension coil a positive electrode may be placed, for instance, upon the cervical spine and a negative electrode applied to the muscles of the forearm and the E. M. F. regulated from zero to maximum so as to cause any desired degree of contractions between the merest perceptible impulse beneath the negative electrode and vigorous yet agreeable exercise of the entire limb. In all therapeutic work requiring muscle stimulation of this character an exact regulation of the dose must accord with the effect sought.

If the interruptions are now carried to an extreme rapidity of many thousand per minute (20,000 to 30,000), a strong current will set up a tetanic contraction, and a current strength

beyond tolerance applied in this way will soon tire the tetanized muscles; but by moderating the dosage and also the method of applying the same coil current with the same rate of interruption a great variety of effects can be produced. Muscles can be restfully exercised, the circulation and nutrition of parts improved, congestion and pain allayed, and fatigue and pain caused by previous improper application of too strong a current can be speedily removed.

The physiological effects of induced currents are therefore not the inherent properties of certain long, medium, or short, fine or coarse coils, but are the product of method, dosage, and manipulation, of E. M. F., amperage, circuit resistance, rate of interruption, and special electrodes. An understanding of this practical fact will straighten out much of the prevailing confusion about choice of coils and different lengths of wire.

Slowly interrupted faradic currents act but little upon non-striated muscles. Rapidly interrupted induction currents, however, contract involuntary muscular fibre, set up intestinal peristalsis and produce other effects not possible with only a slow vibrator in circuit.

The more rapid rates afforded by an adjustment of the slow vibrator (from two hundred up to two thousand per minute) may be employed as vigorous electrical massage and to break down adhesions, but are not suited to functional contractions of groups of muscles, or for sedation.

If employed in vaginal faradization to stimulate muscle fibre the application should be short, as more than a few moments' use of such a current over-stimulates muscles and produces exhaustion if a strong, stimulating dosage is employed. Short sittings with this character of current are also useful within the pelvis to break up adhesions and exudates and disperse venous engorgement after inflammation and tenderness have been removed by sedative currents.

The most remarkable effects of faradic currents are obtained when the make and break follow each other with intense rapidity and in a perfectly smooth and even manner. The

quality of the rapid interrupter is, therefore, more than any other single part of the apparatus, the key to current quality, character, and effects.

The therapeutic work accomplished by induction coil currents upon and within living tissues is inseparably associated with the contraction of muscle fibre. Control and management of these contractions in different degrees produce widely different effects. They unite upon nutrition the good effects of exercise, warmth, increased blood supply, and massage. They are a circulatory, muscular and nerve stimulant, tonic or sedative, according to the manipulation and dose. They contract blood vessels as well as muscles, quicken the circulation, combat blood stasis and promote the absorption of recent effusions and effete products.

The ordinary faradic battery in common use is so incompetent a therapeutic instrument that few physicians are prepared to appreciate the importance of improved coil currents in other realms of physiology beyond the gross muscular contraction that any interrupted current will cause. The effects upon metabolism, upon functional and nutritional processes of what are now called high tension currents from improved and scientifically constructed apparatus are of a remarkable nature. They command interest and demonstrate result, which no drug medicinal agent can produce. By their general application the processes of oxidation are quickened, the elimination of urea, carbonic acid, and water is increased, and incomplete food combination is carried forward to more complete combustion, assimilation, and nutrition.

More and more with each step of advancing knowledge the general effects of electricity in palliation or curing many diseases are accounted for by its influence upon nutrition. "It aids nature to restore the sound state." The action of an electric current starts a process which continues long after the current stops.

Rapidly interrupted, high-tension induction currents set up within the tissues what may be considered as fine, vibratory,

molecular or protoplasmic massage instead of gross muscular contraction. When these vibratory impulses are directed with the blood current they re-inforce the vermicular movement of arteries and the functional activity of nerves. Vibratory impulses in the opposite direction diminish both nerve and arterial currents, just as counter-vibrations act elsewhere throughout mechanical-physics. A rapidly intermitting, moderate current in the direction of the blood flow increases the blood current, and in the opposite direction retards or lessens it, hence, it is the usual rule to act upon this idea in placing electrodes and selecting polarity in applications which require that these effects be taken into account. The induction coil current with its marked polarity possesses this advantage over the alternating current which is constantly reversed and has no polar difference.

With electrodes applied upon the surface of the body the effects of rapidly interrupted high tension induction coil currents depend upon the current strength (E. M. F.) and manner of application,

With a mild E. M. F. the effect is superficial and chiefly vasomotor and sensory. With a gradual increase of E. M. F. with stabile electrodes, the current gradually grasps the subjacent muscles in proportion as penetration increases with voltage, and finally maintains a physiological tetanus.

This tonic contraction is sooner developed if one electrode rests upon a motor point. If one electrode is whipped over the various motor points of a part, or if it is lifted from the surface and the muscles are simply touched by it at regular intervals, there results peculiar contractions of the affected group of muscles which are of a different character from those produced by the transient impulse of a slow-vibrator current. They contain the tonic, vaso-constrictor effects of the high frequency current and produce a muscular exercise which is unique in kind. A fatigued arm thus exercised with practiced skill is rapidly refreshed instead of being made more tired, and quickly takes on a feeling of lightness and buoyancy.

An opposite effect is produced if the electrode is steadily held upon the motor point. The irritability of the nerve is then reduced, and, if a sufficiently strong E. M. F. is persistently maintained the muscle may be tired out. Tonic spasm is sometimes thus relieved by exhausting the over-excitability. What would be a sedative, or even anodyne action of a given current may be merged into a sedative-tonic or even stimulating effect by simply changing the operative technique.

We have thus seen that a variety of actions upon living tissues can be demonstrated by high efficiency faradic currents considered as a whole. They increase secretion, will cause perspiration of the hand holding a bare metal electrode; will promote synovial lubrication in dry and creaking joints; they stimulate nerves of special sense, will cause flashes of light before the eyes, and a metallic taste; they increase metabolism and act as a sedative tonic, nutritional stimulus; they effect nerve sedation and circulatory tranquilization, allay pain, promote absorption through the capillary and lymphatic circulation, combat blood stasis, relieve congestion, and will both reduce acute local inflammation, or hasten suppuration if this is inevitable. It is currents of this character which have revolutionized the uses of faradic electricity and rendered the common battery obsolete.

The pelvic effects of high tension induction coil currents call for special remark. They are as interesting and valuable as any within the scope of electro-therapeutics and no physician in either general or special practice who has women for his patients can, at the present day, afford to remain uninformed on this subject.

Upon the skin, supplied as it is with sensitive nerves and offering some resistance to the current, the polar actions are localized near the electrodes or the current passes between them without much lateral diffusion. In the soft, moist cavity of the pelvis, however, the conditions are radically different and are singularly fitted to wide diffusion of the current, and to painless tolerance and utilization of doses that are far

beyond the pain-bearing-limits of the sensitive skin. The mucous tissues are well-nigh as good a conductor of these currents as a salt solution; they are circumscribed by a periphery which is a bad conductor, and within the cavity the diffusion of the current by the bipolar method reaches every tissues and immediate ramification of nerves and vessels.

This high conductivity, low resistance, and compact relation of the pelvic organs creates possibilities for the bipolar method of faradization that do not exist elsewhere in the human body.

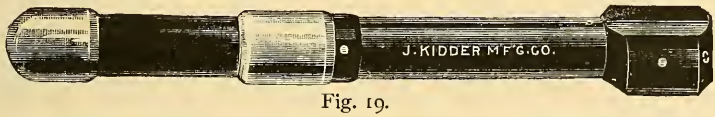


Fig. 19.

Correct form of bipolar vaginal electrode employed with high tension coil currents in gynecological uses.

The credit of the happy and manifold effects of this method in peri-uterine diseases is due as much to these favorable conditions as to the properties of the current. The full effects of vaginal bipolar faradization are difficult to state in words for they are dependent on the state of the patient and the local pathology, as well as upon a score of variations in dosage and management of the current which may be imparted by operative technique.

Within the pelvis the first marked effect is the relief of tenderness and pain if these exist. The application can be made either sedative, anti-spasmodic and anti-congestive, or tonic, stimulating, and muscle-contracting. If stimulating, it quickens the capillary circulation, contracts the small arteries, augments the blood pressure and disperses nervous engorgement. The powerful current stimulates the contraction of all intra-pelvic muscular fibres and the absorptive processes of the lymphatics, relieves local congestion, and accomplishes rapid absorption of recent infiltrations and exudates. "It is the most powerful, certain, and therapeutically valuable vasomotor constrictor we possess."

The sedative action of these currents applied so as to produce local sensory anæsthesia and recuperative rest is incomparable with any other medicinal agent. For the relief of pelvic pain and congestion, and pelvic inflammations and their results, infiltrations and exudations, vaginal bipolar faradization acts not only as a remedy for the symptoms but with distinctly curative effects. As an auxiliary to other measures beyond its direct capabilities it performs a service of extraordinary value in many cases. It serves an exceedingly useful purpose preparatory to surgical operations by its tonic action upon the local tissues and by improving general nutrition. The disappointment so frequently the lot of patients who have submitted to an operation only to find their pains unrelieved may be often removed by subsequent applications of some form of electricity.

Sedation to the mind and an increase of general nutrition are among the promptly noticeable effects of vaginal bipolar faradization. The entire nervous system is soothed, sleep is improved, appetite and digestion, renal elimination and other functions are benefited.

One of the perplexities of the student of electro-therapeutics who has been accustomed only to the single coil battery relates to the uses of so many different coils as are part of scientific apparatus. Let us note what actually happens when different coils are practically tested by the clinician. The facts are easily demonstrated with a high tension induction apparatus containing a secondary circuit rheostat.

If the resistance is proportioned to the different degrees of voltage so as to diffuse or limit the action of each coil through about the same area of tissue—and this can be done—it is demonstrated that each and every coil in an entire set of twenty-one combinations can be adjusted to produce very similar mild and medium effects, although the maximum currents of different coils exhibit very different degrees of localized current strength.

The tissue-penetrating power of any current depends upon

its E. M. F. *versus* circuit resistance. If resistance remains the same a high voltage impulse will diffuse into the tissues further than an impulse of lower voltage, and hence will appear to be milder, or, as is commonly stated, more "sedative." Conversely, the low voltage impulse will be less diffused, act upon a less area of tissue, and this concentration of the dose upon a reduced number of muscular fibres makes it appear to be stronger or more "stimulating."

When this is understood we see that the purpose of a variety of coils is to enable us to obtain all needed doses to procure given effects in different cases, rather than to supply a great number of *different* effects by multiplying the number of coils.

It is generally stated that the primary coil relieves pain, that the short, coarse, secondary coil is for muscular contractions, that medium coils are for the same use when parts are too sensitive to endure coarser, and that the long, fine, secondary coil is for sedative effects. Sometimes it is stated that the coarse coil causes painful contractions and the long coil does not, while others have reversed this statement and set forth various and complicated views.

The effect of any coil current will vary with alterations in the inducing force, the rate of interruption, the character of the interruption, and the resistance of the circuit. I have repeatedly adjusted the resistance so that trained physicians with their eyes shut could not guess whether the current they were experimentally testing to corroborate these assertions came from the shortest and coarsest, or longest and finest coil in the series. A coil of 154 yards of No. 21 wire and a coil of 8,000 feet of fine wire can be made to produce moderate currents so alike to sensation that the most expert electro-therapeutist cannot tell them apart.

These remarks of course do not apply to the *unregulated* effects of coils of different calibre, length, and number of windings. In ordinary practice coils have usually been tested with a fixed inducing current and *without the necessary rheostat in the secondary circuit.* In this case there is no *regula-*

tion of resistance, and the gross maximum currents of different voltage and amperage from different coils appear to affect tissues differently because they are not really acting upon the same tissues but are either concentrated or diffused according to voltage.

A variety of coils is required by the differing clinical conditions under which dosage is regulated. Knowing the effect we seek to produce we can pass from one coil to another, if the first falls short of the mark. With a complete high efficiency apparatus with a means of regulating the resistance in the secondary circuit, the question of which coil to select for a given case becomes simply one of a moment's test to arrive at the requisite current strength with any coil that will produce it without hampering ourselves with theoretical considerations.

Every physician who can adjust a vibrator, regulate the current strength and apply electrodes correctly, can procure these effects at will, and has at command a remedy of incalculable clinical value. From the study of the two preceding chapters to the successful treatment of patients, is but a short step.

CHAPTER IX.

THERAPEUTIC EFFECTS OF "HIGH FREQUENCY" CURRENTS.

THE physiological effects of currents of high potential and high frequency upon protoplasmic metabolism have been pretty thoroughly investigated and determined during the past five years. They are summarized by Apostoli as follows:

Clinical tests upon more than a hundred patients show that these currents exert in the majority of cases a most powerful and generally beneficial action upon diseases due to *slackening of the nutrition*, by accelerating organic changes and combustion. This is proved by analysis of the urine made by Dr. Berlioz, of which the following is a brief *résumé:*

The quantity becomes more normal; the products of organic waste are better eliminated. The increase of combustion is shown by the diminution of uric acid, while the percentage of urea is generally increased. The relative proportion of these two substances changes under treatment, so as to reach in general the figure of 1/40. The elimination of the mineral products is also changed, but in a manner less marked.

When daily *séances* are given, each lasting fifteen minutes, we may generally observe in patients submitted to the influence of these currents the following modifications in their general condition. We mention them in the order of their occurrence.

Return of sleep.

Increase of strength and vital energy.

Increase of gayety, of power for work, and ability to walk.

Improvement of appetite, digestion, etc.

In short general progressive improvement.

This general improvement often manifests itself after the first *séance* before any local influence is apparent, and before any change has occurred in the urinary secretions.

Local pain and trophic changes are often more slowly affected by these currents, and are at times, entirely refractory for a longer or shorter period, and in such cases, the same currents must be applied locally by contact with the electrodes, for general electrization by any form of current must be localized at the seat of local pain.

The diseases which have appeared to derive most benefit from this therapeutic agent belong to the arthritic class; rheumatism, gout and diabetes.

In conclusion, the currents of high frequency and of high tension introduced into electro-therapeutics greatly increase the field of action of medical electricity. They furnish general medicine with a new and valuable means of treatment capable of modifying more or less profoundly the processes of nutrition through the vasomotor system and exerting a powerful action upon all living bodies subjected to inductive influence.

Although the above remarks were written with reference to the currents from peculiar apparatus, they apply equally to currents from static machines which furnish high potential, and high frequency currents for medical use, in their most practical forms.

CHAPTER X.

THE ESSENTIALS OF STATIC ELECTRO-PHYSICS.

Care of the apparatus. Dose regulation. Standard current tests.

The Essentials of Static Electro-Physics.—The static machine is purchased complete from the manufacturer, and to describe its construction and mechanical parts is superfluous. The few essential directions obtained from the maker at the time of purchase inform the buyer about the mechanism and all that remains to learn is familiarity with clinical methods.

The range of usage to which this great machine may be put, from the simplest electrification of a patient to the production of the most powerful X rays, separates it widely from any other type of electrical apparatus in either the industrial or medical field.

Prior to Roentgen's remarkable discovery the static machine remained *caviare to the general.* Those who were never near enough to a fine machine to touch it, or who viewed it through the spectacles of others who unsuccessfully employed an inferior and ill-kept apparatus, were indifferent to its splendid capabilities; but any physician who will take a little trouble to practice the proper treatment of patients with this apparatus can demonstrate in his own office that it is the most efficient and valuable single appliance in therapeutics.

It is now not only a satisfactory but an indispensable part of the electro-medical equipment of both the specialist and the general practitioner. It has become a necessity also to the surgeon, and having become acquainted with its usefulness through the enlightening influence of X rays he will find it of great practical value in the post-operative treatment of a great

variety of cases. The clinical results procurable by the aid of the static machine are largely dependent upon the skill of the operator. It has been imagined in some quarters by those unfamiliar with the subject that less skill is required in the employment of static electricity than in the use of galvanic and faradic currents. This error explains why those who hold this view and carry it into practice are disappointed in their clinical results. It is useless to attempt the employment of the static machine as an automatic cure-all.

The galvanic current requires proper care and attention to detail in its administration, yet when the electrodes are in contact, the circuit closed and the dose adjusted, the electrolytic and therapeutic action goes on independently of the operator.

This is not the case in static therapeutics. During every instant of treatment the effects procured depend upon technique, management of the patient, machine, and electrodes, and not upon the intrinsic properties of static currents. The small therapeutic value of static electricity in the hands of a novice and the great value of the same agent when the administration is properly conducted exhibit a disparity which is almost beyond belief.

To produce the best results each form of medical current must be administered with proper skill, and in this respect they are all alike. Any physician who obtains a proper course of clinical instruction in the management of the static apparatus and will devote a short time daily for a few weeks to improving his skill by practice, can accomplish both the best quality of X ray work and therapeutic results of great value by the aid of the static apparatus.

In this chapter I shall consider only essential points of clinical usefulness.

It is an important starting-point in the perfect working of the static machine that it should be properly set up in the physician's office. It should stand evenly and firmly upon the floor so that when in rapid motion it will neither jar nor shake.

If it is run by a motor, the belt should be joined by a small steel hook embedded into the leather and make no click when it meets the wheel. The plates, combs, collectors, and all the internal parts should be correctly adjusted so that none grate or rub upon each other. Without an accurate adjustment of the machine it cannot be expected to operate satisfactorily.

The revolving glass plates should turn evenly and smoothly, and when everything is in proper order the machine should be nearly noiseless when in action. In many respects the care required by a static machine resembles the care usually bestowed upon a choice piano.

It should be placed in a large and dry room. An inner room, or one in which the sun freely enters, is to be preferred. It should be covered when not in use, and should be daily dusted, and its metallic parts kept bright with a rouged chamois. The electrodes should be similarly treated.

There exists an active affinity between all parts of a static machine and the floating particles of dust in the atmosphere of a room, and for this reason it should be protected from dust as much as possible.

Attention to these details will maintain the beautiful appearance of the machine and keep it from looking tarnished and neglected. The entire case, metal parts, platform, rod, and chains should be kept scrupulously clean.

When the machine is first purchased the external brass parts and electrodes will be found coated with shellac which is a bad conductor. It must be dissolved with alcohol and entirely removed from the sliding poles, rod, and metal parts of all the electrodes.

At the very commencement the interior of the case must be thoroughly dry and ever after kept so. The method of keeping the interior dry deserves special attention, for the successful employment of the machine depends much upon the absence of internal moisture.

During the seasons of the year when the atmosphere of the

house or office is artificially dried by furnace or other heat there will of course be no additional necessity to dry the interior of the machine, but in summer when no fire is used and when the doors and windows are frequently open, every misty or rainy day will saturate the air of the house with moisture. This is the period of discontent for the static machine, but its evils are moderated by judicious care. Various expedients have been suggested to dry the internal plates, but one and all methods heretofore mentioned for this purpose should be discarded for the following plan, which is now universally adopted as the best.

Obtain two or four fire-proof dishes or bowls of common white crockery, not too large to enter the case, but sufficient to hold together ten pounds of chloride of calcium. It is furnished in hermetically sealed containers of ten pounds each. It is usually taken from the can and put directly into the machine by uninstructed operators, but this should never be done, for it is exceedingly hygroscopic and always contains more or less water when purchased. Unless this is first evaporated and the chloride thoroughly dried it will liquefy more rapidly and be far less effective in the case.

Accordingly divide the contents of the can between the dishes and bake them in a moderate oven until the calcium is white as chalk. It may take but an hour or two, or an entire day, depending on the quantity of moisture to dry out and the relative heat of the oven, but bake it till it is thoroughly dry no matter how long it takes.

The heat should not be sufficient to boil the water (if part of the chloride is in a liquid state), or it will run over the edge of the dish and not only waste but necessitate cleaning the oven. Never let any liquefied chloride of calcium spill on a carpet or the floor of the office, for it is a disagreeable substance.

When an examination shows the baking to be thoroughly done remove the dishes from the oven to a suitable pan, cover them with a dry towel, carry them to the machine, and trans-

fer them quickly to its interior. Instantly screw fast the doors. The machine will then be ready to operate.

The chloride of calcium may be rebaked as often as necessary, and by using dishes that can be put in the oven without injury the same material can be utilized again and again with very little waste. I use the same chloride for at least a year before throwing it away and procuring a fresh can. In the winter time it remains dry and is practically not needed within the machine, but I leave it there because it is the safest place to store it where it can be found. In the spring and fall seasons I take it out about once a month and in the worst of dog-days about once a week, but the actual state of the chloride is the indication for baking it again and not the lapse of any particular time.

The next and more important matter to attend to after a new machine is set up in running order in the office is to provide metallic groundings for both poles, and for the several electrodes.

Uninstructed operators often drop a chain from the sliding rod to the floor, but the clinical results of such physicians are not always gratifying. When a current of electricity is conducted to earth it should be by a metallic route, and a high potential difference between the static poles depends upon good conduction, as well as upon the capacity and power of the machine. Static electricity has no fixed voltage. The operator controls it by his management of the apparatus.

Two separate groundings are essential. Without them the machine loses fifty per cent. of its efficiency. If the office contains gas and water pipes both, they serve the purpose. If not, the physician can drive two pieces of iron pipe into the ground deep enough to reach moisture, and connect these with convenient situations in his office by heavy copper wires. As there are few offices which do not contain running water and gas I shall proceed to describe how to employ them as groundings.

Procure a necessary quantity of stout copper wire. Tack a

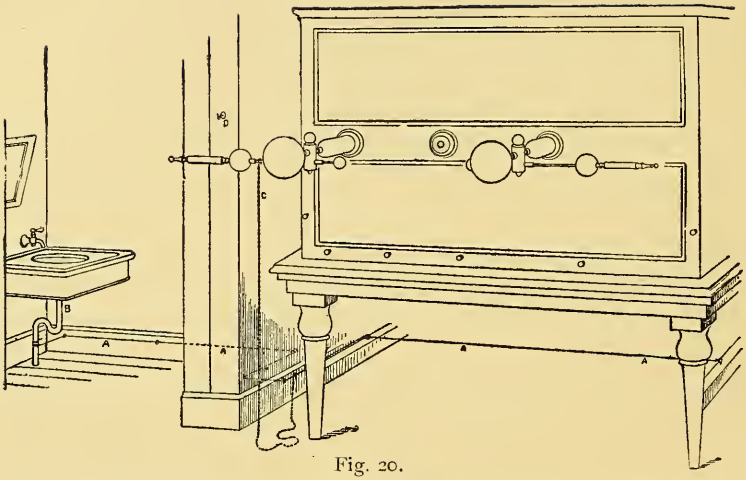


Fig. 20.

Grounding to the Water Pipe. *AAAA* is a stout copper wire passing under the frame of the machine, through the wall, to the most convenient water pipe, *B*. This may be either in the same room or in another room. Any water pipe which can be reached with a wire from the machine will answer the purpose. *C* represents the chain dropped from the prime conductor to the floor and hooked over the wire *A*. *D* shows the hook in the wall upon which the chain is hung when not in use.

piece of it under the table of the machine and carry it along the baseboard of the room to the water pipe, to which the end of the wire should be permanently fastened. This is utilized for grounding one of the poles of the machine, by linking one end of a brass chain to it, and hooking the other end of the chain upon the sliding pole which is not connected with the platform during treatment. To remove the grounding after treatment simply unhook the chain from the sliding pole and hang it on a convenient peg in the wall, or drop it on the floor.

The gas fixture grounding requires no preparation if a chandelier from the ceiling is in convenient relation to the platform and is brass. If it is bronzed iron or some composition which is a poor conductor a piece of stout copper wire should be bent into a hook at the lower end and carried up the chandelier and twisted around the gas pipe at the top. If the chandelier is not conveniently situated, or does not exist at all, a copper wire can be run from a side bracket to some point where a hook at the end will be most handy for the operator.

The grounding of the electrode is accomplished by attaching the swivel of another brass chain furnished with the machine to the ring upon the metallic part of the electrode and hooking the opposite end of the chain upon the chandelier or wire connected with it.

No operator who has not provided metallic conduction to earth can create a high-potential difference between the opposite polarities, and therefore cannot equal the best therapeutic work of which his machine is capable.

After providing conduction for the indifferent pole and the electrode, the next step is to provide good and direct conduction from the active pole to the patient. Poor conduction in this respect is a fruitful source of failure. If the platform surface wastes half or two-thirds of the current before it gets from the end of the rod to the patient it must be furnished with a better conductor, for extravagance in current waste is fatal to therapeutics. New platforms are sometimes varnished,

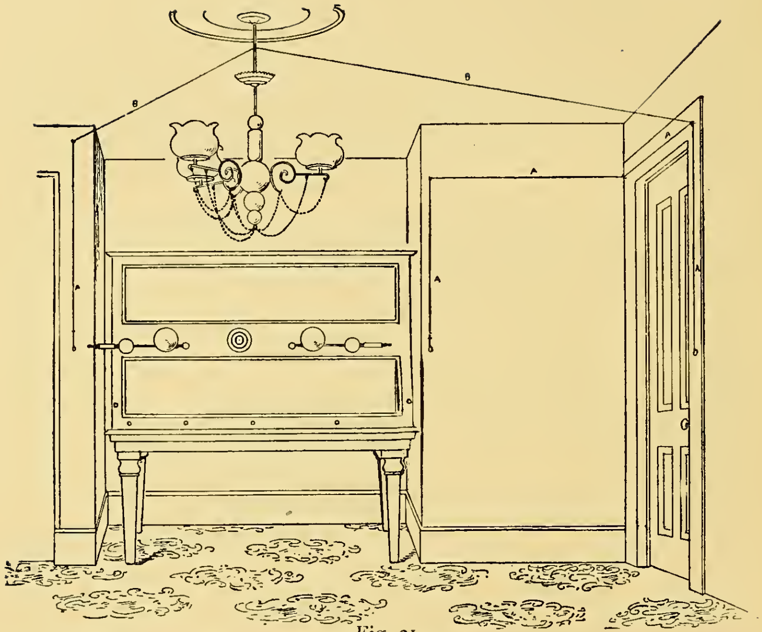


Fig. 21.

The above diagram illustrates the author's use of the chandelier as a grounding for either machine or electrodes as desired. Stout copper wires *AAAAA* are carried from hooks in three convenient situations upon side walls near the static machine to wires *BB* which stretch from the top of opposite doors to the central rod of the gas fixture which conducts the current to the earth. I either attach the chain of my electrode handler to the lower portion of the chandelier or to any one of these hooks, whichever is convenient for the situation in which I stand to treat a given case.

shellaced, or oiled, and shellac, varnish, and oil are all bad conductors.

An oak platform with natural wood surface is probably the best for static use, and this can be dampened a little from time to time and its conducting efficiency increased. Metal, however, is by far the best, although in some forms of application it possesses drawbacks which require experience to overcome. By far the most efficient way to get a current directly into the patient is through a metal tray placed under the feet, or a chain or rod held in the hands. I habitually use a brass tray about fifteen inches square, to one corner of which is attached two feet of chain. When the rod from the prime conductor is placed upon the platform in the usual way the free end of this chain is thrown around it and direct conduction is secured.

As every screw about machinery in active vibration will tend to work loose, it is necessary from time to time to tighten the screws that close the doors and secure together the framework of the static apparatus.

Every joint about the machine must be constantly kept as firmly tightened as possible. Some of the internal screws will occasionally work loose and permit two plates to rub together, or a comb to scratch and grate upon one of the revolving plates. When this happens it calls the operator's attention to it by the noise it makes and the trouble should be corrected by removing a door, setting the comb or movable plate back into proper position, tightening the screw, and closing the door again. The case, however, should be opened only when absolutely necessary, and a dry day selected for this purpose, for it at once lets the air of the room into the machine and temporarily lowers its working capacity.

Very few parts of the improved Holtz machine require oiling. One of my former machines, with an axle bearing, required regular oiling through an external oil orifice at each end of the axle, but this method allowed some air continually to enter the case and involved an extra amount of friction. My present apparatus contains ball bearings en-

closed in a permanent oil bath, with no openings to let in the air, and with the friction reduced to a minimum. These bearings constitute a great improvement in the apparatus and were introduced by the manufacturers at the author's request. As a veteran bicycle rider my familiarity with the advantages of ball bearings induced me to repeatedly urge their merits upon the makers of the Holtz machine.

Charging this machine simply involves the principle of joining by metal conductors both poles of a frictional machine which will develop electricity by friction in all atmospheres, to the two poles of an induction machine which will develop nothing until the germ of the current is supplied, setting both sets of plates into action, and continuing until the induction plates take up the minor frictional discharge and magnify it into a high-potential current.

The process may be instantaneous on a dry day, or may require a dozen seconds under ordinary circumstances. A good deal depends on the dryness of the chloride within the large machine, and on the deficiency of the small frictional apparatus. On a damp summer day I have seen a small charger that was out of order consume half an hour in charging the induction plates. A charger that will give only a quarter of an inch spark between its two poles will be very apt to do this. The charger within my present apparatus is constructed in a much better manner, with larger plates and better workmanship, and will give a one-inch spark. Its action is successful, convenient, and satisfactory.

The static machine occasionally reverses its polarity. To prevent this occurrence Holtz introduced his ingenious diagonal conductor, a device which does not fully remove the fault, though it greatly increases the stability of the electrical charge. When this occurrence takes place in practice it is only necessary to become aware of it, aud connect the platform with the desired pole for therapeutic effects, provided that no inconvenience to the operator results from the reversal.

Sometimes, however, owing to the situation of available

space and the relation of office accessories, it may be a practical necessity to have the positive pole always at a particular end of the machine, where the physician becomes accustomed to its use with the most satisfactory convenience. This being my own case a few years ago, a reversal of polarity operated as a decided hindrance, and I therefore investigated the conditions which appeared to influence the shifting charge, with the result that I discovered a method of correcting the reversal, and described the same in the *Medical Record*, February 24th, 1894.

Thoroughly discharge the machine, and subject the plates to a sharp jar in some manner that is consistent with safety to the apparatus. With a six-plate twenty-six-inch machine the simplest method of doing this is to lift the positive end of the case a very short distance from the floor and drop it, using the precaution to avoid any damaging violence. An eight-plate thirty-inch machine is rather heavy to lift.

Other methods are: Strike a few sharp taps with a hammer on the outer end of the brass cross rod supporting the upper set of diagonal combs, jar the case by blows upon its floor or side, etc. With care no damage whatever will be done the machine.

To demonstrate success, recharge the plates, and if the positive has not yet shifted as desired, try it again. On a good day for static the charge is sometimes more tenacious, and the object is not so readily accomplished. It then simplifies the matter to open both doors and discharge the machine more thoroughly.

To discharge the Holtz machine when desired, revolve the plates backward until no spark will pass between the sliding poles when they are brought gradually together until they touch. Then touch each prime conductor with a grounded electrode and start the machine into action in the usual way. If the machine is discharged it will now produce no current. If the attempt to discharge it has not perfectly succeeded try it again. I kept a record during one year showing that my

machine reversed thirteen times, and each time I corrected the change by the method above described. It sometimes took me only a moment, and once or twice it required half an hour to restore the desired polar relations. In my present office I have abundant room, and need make no attempt to correct reversals.

When the machine is not in action the poles should always be left some distance apart. If they are short-circuited by being placed in contact after the machine is stopped, it tends to cause a discharge, and require recharging the next time a patient is treated, although the state of the weather will affect this somewhat.

Operation of the Static Machine in Summer.—I have often been spoken to by physicians about the trouble they experience in getting an adequate current into the patient during rainy seasons in July and August. In some cases their machine gives a good discharge between the sliding poles, but little or nothing reaches the patient.

It is difficult to say at a distance what may be the cause of the trouble in any given case. Non-experts sometimes think their machines are in perfect order when they are actually the reverse. They may also regard the conditions of the room favorably when the trained operator of static apparatus would at once detect a weak point.

If the machine and room are dry and in good order the work done in July and August should rarely disappoint. In my own case I have entire confidence that my machine will work on every day in the year, for if it fails for a moment I speedily correct the trouble. The mastery of the conditions which enables me to do this can be acquired by other physicians without a doubt. I have never failed to quickly discover the cause of defective action in the case of machines in other offices when I have been able to make a personal examination, even though previous correspondence failed utterly to suggest the trouble.

It should be remembered, however, that few owners of static

machines have been carefully instructed in their management. They have usually bought an apparatus and picked up haphazard their slender stock of knowledge about it. The machine is far too valuable to be viewed in an indifferent manner, and it will well repay the time and cost to procure the best instruction possible.

Motor.—The consideration of motor power in connection with the static apparatus is quite important. Physicians in different localities have different methods available. Some will find it necessary to employ water as the power. Some have put in small gas engines. Some engage a boy to turn the machine. But wherever an electric street current is available an electric motor is the most satisfactory method.

A primary battery for power is out of the question, and secondary cells would be inconvenient, expensive to operate, and are also practically out of the question at the present time. When an alternating current runs through the physician's street there is, I am informed, some difficulty in obtaining a small motor that it will operate with satisfaction. The direct 110-volt current is available in many places, and, as my personal experience is limited to this current, I will describe only what I employ myself.

I have a one-sixth horse-power Crocker-Wheeler motor. A one-eighth or even one-twelfth horse-power will run a static machine in perfect order, in perhaps half of its work, but as time goes by, and the plates may sometimes rub against each other and greater resistance may develop from other causes, it is wise to have some power to spare, and for this reason a one-sixth horse-power motor is always preferable.

I employ but a single belt, running directly from the central shaft to the motor. My machine has no fly-wheel, but the Wimshurst charger is operated by hand with superior convenience whenever it is needed. The use of the fly-wheel to operate both the charger and the larger plates involves some minor drawbacks. The additional friction is something, but the wobbling appearance of the revolving wheel, which is

almost always in the eye of the patient and the physician, becomes very unpleasant to any one who is accustomed to an invisible mechanism.

I regulate the speed of the motor by a rheostat which was made especially for me. It has a resistance of 125 ohms, divided into 25 steps, so that the switch gives very even gradations of speed from the maximum down to a complete standstill.

When the machine is not in action the current should not be left passing through the fields of the motor, but should be switched entirely out of circuit in the way that an electric light is cut out. I have such a switch attached to the wall near my machine so that when not in use no current enters either the rheostat, the motor, or the flexible cords, and all danger of heating is eliminated from the portion of the circuit which is inside the office.

A new motor will almost always give a little trouble until it gets settled to working order. It must receive sufficient, but very simple, care. The oil cups will need filling once in about two or three weeks. Whenever the commutator becomes blackened it should be made to revolve while a piece of OO sandpaper is held against it to remove the carbon. If too much oil is put in the bearings it will at times work up on the commutator and must be wiped off with a clean rag.

It is of the first importance to have the brushes in proper relation to each other, and to the centre of commutation, in a given motor. These centres differ in different types, and ordinary electrical workmen who simply wire houses for bells and lights are almost always ignorant about the adjustment of a motor, and will leave the brushes in a position that will encourage heat effects and possibly sometimes ruin the motor coils. I speak of this because of a personal experience with the ability of workmen to botch a job they do not understand.

If, when the motor is put in position, the wheel revolves the wrong way, it can be reversed by simply transferring the two short wires which connect its opposite poles.

Whenever the belt stretches it should be promptly tightened so that it will not slip on the small wheel.

Those who may order a rheostat for the control of a one-sixth horse-power motor would do well to specify a resistance of 175 ohms instead of 125, and the higher resistance will give control over the speed when the machine is short-circuited and running without resistance. I employ a bank of lamps for this purpose, but when the apparatus is all purchased at once the rheostat can easily include all the resistance that may be needed.

The dosage of static currents in general electrification with either pole is affected by the following:

1. Rate of revolution of plates from very slow to very fast, the activity of current output being in proportion to their speed.

2. Good or bad conduction of the current from the machine to the patient, and the insulating capacity of the platform.

3. Attraction of the current away from the patient during electrification.

4. Reinforcement of direct current by Leyden-jar condensers.

5. General atmospheric and physical conditions of the machine and the office.

6. Operative skill of the physician.

The means at our command to modify, increase, or decrease the strength of treatment, and regulate its force to suit the varying requirements of disease, are complete and adequate in the case of static electricity without employing either a meter or a rheostat, such as are necessary with galvanic currents. No such instruments are made for use with the platform applications of static electricity and we would not need them if they were.

With the patient in position for treatment the poorest method of connecting the pole of the machine with the patient consists in resting the lower extremity of the brass rod upon

the corner of the platform surface most distant from the person's feet.

A great deal of resistance must be overcome before the current reaches the patient, and the great difference of potential between the prime conductor and the patient, when both should be alike, is detected by requesting him to touch the rod with the hand and note that a spark will pass. It is obvious that by this manner of placing the rod the patient will receive a very weak current and only a small part of the actual output of the machine.

The weakest output of the machine is obtained by the slowest revolution of the plates. Stronger electrification will be secured by pushing the end of the rod nearer the patient's feet and making the plates turn faster. No wooden platform surface is, however, a very good conductor. In damp, sultry July and August weather the atmospheric leakage of the current may be more rapid than the conduction over the platform to the patient. The insulating resistance of the air is diminished by the dampness, and a good spark is then difficult to obtain. If increasing the machine activity does not sufficiently increase the patient's electrification, we must better the means of getting the current into him. The best that can be accomplished in this direction will be done by cutting out all bad conducting material between the prime conductor and patient, and substituting metal.

Have the patient hold the brass rod in the hands, if this does not interfere with any desired local application, otherwise put a metal tray under the patient's feet and let the rod rest upon the platform as usual, but connect it with the foot-plate by a brass chain. At all times of the year this method of metallic contact will produce the most vigorous electrification with a given rate of the machine. In winter time it will enable the operator to obtain a maximum current without a maximum speed. In the summer time it is a necessity anyway.

If still further means of increasing the current strength are

required on a summer day, the machine can be dried more thoroughly with freshly baked chloride of calcium, the office may be closed, and a grate fire or a few gas jets be kept burning for a short time to dry the atmosphere, and the small or even the largest Leyden jars may be attached to the prime conductors and their outer coating connected.

With these precautions almost any form of desired treatment can be given during the worst season of the year. No one, however, should employ the Leyden jars until he is well trained in the use of static electricity, for a patient would be exceedingly unlikely to call again if an accident happened through the operator's want of skill, although the accident would be harmless.

To add strength to local applications of the breeze, spray, and frictional spark, we may have the patient hold the brass rod so that the upper end will not be in direct contact with the sliding pole but will rest about three-quarters of an inch away, and a spark stream of this length will intensify the velocity of the flow.

By some modification of these measures every practical increase in the vigor of any form of application may be regulated with exactness, and to weaken the administration if it is too strong these steps may be reversed.

The spark can be modified in length, thickness, and strength by (1) leaking off part of the current through the operator's foot, placed for the moment upon the edge of the platform; (2) by turning the machine more slowly; (3) by removing direct metallic conduction and placing the brass rod directly upon the wooden platform and (4) farther away from the patient's feet.

A very mild breeze or spray application may be made by simply holding the metallic part of the electrode in the hands instead of giving it metallic conduction to the earth.

A mild spark can be given in the same way, but causes a contraction in the operator's wrist.

It should be noted that in any continuous electrification or

breeze application, the direct metallic connection with either the hands or feet of the patient produces no sensation whatever. The moment the current is interrupted by any form of spark discharge the patient must be protected from annoyance by the operator. A strong spark given with positive electrification and the rod held in the hand will cause an annoying contraction at the wrist; but with both hands in contact with the rod and negative electrification, an ordinary positive spark may be given with comfort. If shoes are thick-soled, and are filled with nails in either the sole or heel, sparks may sometimes annoy a patient whose feet rest upon the metal tray. With ordinary shoes this does not occur.

The dosage of Leyden-jar currents is regulated by the size of the jar (small medium, or large), by the distance between the sliding poles, and by the rapidity of the revolving plates. The nearest equivalent to a high-tension induction-coil current is obtained from the smallest jars, with the plates revolved very fast to simulate the rapid vibrator, and very slowly to simulate the slowly interrupted faradic current. Extremely rapid rates are best obtained by the use of motor power to operate the static machine. Slow rates of from fifty to one hundred and fifty interruptions per minute for muscular contractions are best obtained when the machine is controlled by hand.

The medium jars resemble somewhat the medium secondary induction coils as respects quantity of current, while the largest jars may be said to resemble the shortest coarse-wire secondary coil. The difference between these jars is a prolific source of argument between those whose electro-therapeutic information is in an embryonic state. Some say that the current from the large jars "causes painful muscular contractions," etc.; but, as a matter of fact, an intelligent regulation of the distance between the poles and the speed of the revolving plates will enable the operator to secure his desired effects with all Leyden-jar currents without any necessity of causing pain with any size of jar.

By regulating, therefore, the manner in which the patient

receives the current from the static machine—whether by direct metallic conduction or through a greater or less intervening gap of air or wooden surface—by regulating the rapidity with which the plates revolve, and by graduating the management of the different electrodes to suit each case, the current can be made as gentle or vigorous as desired.

In a hot, dry room on a crisp winter day, or in a damp room on a sultry day in summer, the knowledge of how to govern the potential and current supply at will is often an inestimable advantage. It is perhaps impossible to set down in writing all the various manœuvres by which an experienced operator consults his patient's comfort during treatment, but sufficient is said above to indicate the general ways in which the beginner may proceed and practice will teach the rest.

Standard Current Tests.—It is not the static apparatus but the operator's use of the apparatus which performs the clinical work.

It is essential that those who follow my teachings should approximate as nearly as possible the same efficiency in the working capacity of their apparatus which I maintain in mine.

I have frequently observed static machines in other offices working at a reduction of twenty-five, fifty and even seventy-five per cent. of their normal maximum. Owners have not seemed aware of this until it was pointed out. Tests of the matter are simple, and each reader can determine for himself how far his current efficiency differs from the maximum. The current may be wasted in either of three places: inside the case, beween the poles, or on the platform.

Test 1. If the machine develops high internal resistance, jumps a spark between a comb and collector when in very rapid motion, with the negative pole grounded and the positive pole connected with the platform, the production of current by the machine and within the case is at its maximum.

Test 2. Short-circuit the sliding poles, start the machine into rapid action, and draw the poles gradually apart. This test should be made in a darkened room. If the convective

discharge holds between the balls of the sliding rods until the distance between the poles is within a couple of inches of the radius of the plates, and if, when the luminosity divides, the "fox-tail brush" stands out in well-defined and splendid radiance from the positive pole, with little or no leakage elsewhere, there is no waste worth speaking of at this very important part of the machine.

Every physician should test his apparatus in this manner. If the brush discharge refuses to form the "fox-tail" appearance, or rather an appearance which more resembles the ordinary whisk broom with its short handle, and jumps across an air gap of only four, six, or eight inches, the output of the machine is wasted somewhere else, if the first test shows that current is generated in abundance inside the case. The place can be detected by the eye in a dark room.

Test 3. With the negative pole grounded and the positive pole placed as usual in connection with the platform on which the patient sits, start the machine into rapid action and request the patient to approach the hand near any part of the platform rod.

If before the hand actually touches the rod a spark passes, the length of it will determine the amount of current waste. As the resistance of the air is very great a very short spark will indicate some waste, and a spark only a quarter of an inch long would indicate a great deal of waste, with a corresponding reduction of the therapeutic efficiency of that operator's work, no matter if the machine itself was the most powerful and finest ever made.

When a patient upon the platform connected with my own machine performs this test, there is absolutely no sensation of the slightest spark discharge between the rod and the hand. This shows a complete elimination of resistance in the external path of the current, and supplies within the patient the maximum output of the machine at any rate of revolution desired.

It is essential to make this plain, for all terms of description have relative meanings, and must be interpreted upon a uni-

form understanding or results will differ. The terms "mild spark" and "strong spark," for instance, may convey to different minds as great a disparity of actual measurement as the terms mountain and hill would convey to the dweller in the Alps and the inhabitant of the prairie. Unfortunately there are no mathematical forms in which to express the dosage of general electrification and localized methods, but under the teachings of experience and careful study it is reasonably certain that all operators can attain sufficient proficiency for valuable therapeutic work with the static machine, if they will keep it in good order.

CHAPTER XI.

STATIC ELECTRO-PHYSIOLOGY.

The actions of static electricity in various forms of application. The importance of familiarity with this branch of the subject. Action upon functions. The chief properties of static electricity determined by scientific investigation before the discovery of galvanism. Cavallo's accurate report. Sedative effects described by Arthuis in 1871. Static electricity as a regulator of functions. Its nerve and muscle reactions. Its effects upon metabolism and nutrition. Mechanical effects of the spark. Vasomotor effects. Revulsive effects. Sedative *versus* stimulating effects. Relief of pains. Its great service in nervous and functional conditions and all diseases associated with malnutrition. Its action upon the deeper tissues of the body. Its great penetrating capacity. Leyden-jar currents. Their physiological actions similar to currents from improved induction coils. Rapid and slow interruptions, and nerve and muscle effects. How to determine the difference between large and small jar currents by actual use. A comparison of Leyden-jar currents with induction coil currents in practical use. Length of *seances*. Principles governing same.

The Actions of Static Electricity in its Various Forms of Application.—No physician of any school can forget his careful training in the important subject of drug action. He may haply forget something about anatomy and relieve his mind of one of the worst bugbears of his college course, but familiarity with drug action must be continuously cultivated throughout every year of medical practice.

It is equally self-evident that familiarity with electric current action upon and within the living tissues is a basic need to the physician who prescribes an electric current therapeu-

tically. Post-graduate study of this subject forms the chief present resource of the practitioner desiring knowledge, but undergraduate schools are slowly taking up the work.

The physician requires facts about electricity for practical medical use and not for mere diversion or prejudice. Among such facts those relating to current action are of fundamental and never-ceasing importance.

The constitutional effect of simple static electrification depends upon existing deviations from normal within the tissues subjected to the action of this current. Just as aconite cannot break a fever in the case of a patient who has no fever, so the static current cannot manifest its predominant action as a regulator of deranged functional processes of the nervous, circulatory, secretory and muscular systems in cases which are already normal. A healthy man will observe little effect from a static administration which would warm, energize, compose and relieve from a dozen accompanying symptoms a patient who had the symptoms to relieve. This may be very elementary teaching, but experience proves that no fact, however simple, can be made too plain.

Endowed with high potential, and extremely small in volume, the physiological effects of static electricity are chiefly modifications of the ordinary vital processes without electrolytic alterations. Static electricity may increase, diminish, arrest, or otherwise modify these functional processes. It affects secretion, excretion, absorption, reflex action, sleep, respiration, circulation and nutrition. Owing to its enormous electro-motive force and its power of condensation and accumulation, it possesses great diffusiveness, which enables it to affect the entire system in a limited degree.

That static electricity had a decided influence upon the physiological functions is not a discovery of our own times,

but was observed before galvanism and faradism were dreamed of. In a work written previous to 1790 we read the following remarks on this subject:

Electricity, strongly communicated to insulated animal bodies, quickens their pulse and promotes their perspiration. If it is communicated to insulated fruits, fluids, and in general to every kind of bodies that are actually in a state of evaporation, it also increases that evaporation, and that in a greater or less degree according as those bodies are more or less subject to evaporate of themselves, or as the vessels that contain them are conductors or non-conductors and as they have a greater or less surface exposed to the open air. By increasing the perspiration of vegetables electricity promotes their growth, it having been found after several accurate experiments that such plants which have been often and long electrified have showed a more lively and forward appearance than others of the same kind which were not electrified.

In 1777 and 1781 there were published in London editions of a treatise on medical electricity, by Tiberius Cavallo, F. R. S., in which is recorded all that was known in his time of the subject in hand. The discerning observations here quoted were made at least ten years before the first forshadowing of Galvani's discovery of a current with chemical and electrolytic properties; and they are not only remarkable for their accuracy, but for the fact that very little has been added to them since. Mr. Cavallo recites as follows:

The remarks made by philosophers relating to the effects of [static] electricity upon the human body in general are the following, viz., that *by electrization, whether positive or negative*, the pulse of a person is quickened, the number of pulsations being generally increased about one-sixth; and that glandular secretions and the insensible perspiration are pro-

moted and often restored when they have been entirely obstructed.

It might naturally be suspected that the promotion of perspiration and of glandular secretion was only the consequence of the accelerated pulse and not the immediate effect of electricity; but the contrary is easily proved by observing that in various cases the quickening of the pulse by other means, as fear, exercise, etc., does not promote those secretions nearly so much, if at all, as electrization, and also the glandular secretions and perspiration are often promoted by electricity when applied only to a particular part of the body, in which case it seldom, if ever, accelerates the pulse.

Hitherto it has not been discovered that [static] electricity acts within the human body by any chemical property, as most medicines generally do; but its action by which it produces the above-mentioned effects may be considered merely as a mechanical stimulation, for it seems to act as such even within those parts of the body which, especially when diseased, are mostly out of the reach of other remedies. . . .

From these observations it appears that the application of [static] electricity does not merely promote any discharge or circulation of fluids, but rather *assists the vis vitæ* or *that innate endeavor by which nature tends to restore the sound state.*

It may, perhaps, be ever difficult to explain in what manner electricity assists that natural endeavor, but experience shows the certainty of the fact, and with it we must be gratefully content; for we may apply the effects to our wants, though we may be ignorant of their cause and mode of action.

When an electric shock is sent through any part of the body, an instantaneous involuntary motion is occasioned, which shows that the muscular fibres through which the shock is sent are expanded or in some other manner convulsed. This involuntary motion is also occasioned by sparks.

Further, when a shock is sent through several substances besides the human body, a tremulous motion and an expansion is evidently occasioned, as may be shown by many experiments.

Now all these observations may perhaps in a manner explain the action of electricity upon the organized parts of an animal

body by comparing it with the tremulous motion given to tubes of any sort through which fluids are transmitted, in order to accelerate their passage or prevent any stoppage or stagnation which might occur.

In my essay upon medical electricity it is mentioned that from the experience of many it appeared that electrization increases the number of pulsations about one-sixth; but having made many experiments upon myself, I added the following observation in the second edition of my essay in the year 1781, and consequently long before Mr. Van Marum's experiments: "I do not remember that my pulse was ever evidently accelerated by electrization, and yet I have tested the matter at various times and with great diversity of circumstances. In another essay I have stated that by repeated experiments, accurately made by Mr. Van Marum and other ingenious persons, it was found that electrization, whether *positive* or *negative*, did neither sensibly augment nor diminish the natural pulse rate in a healthy man. Upon the whole, therefore, it seems to be ascertained that electrization does not increase or retard the ordinary number of pulsations, and the increase generally observed before may have been due to fear or apprehension. But I am now informed by Mr. Partington, who has long practised medical electricity, that electrization, if not in a sound, at least in an unsound state of the body, augments the number of pulsations considerably."

I will here mention a few hints which may promote the investigation especially of the chemical action of electricity, viz., if it adds any principle to those through which it passes as an acid, an alkali, the inflammable principle, etc.

The observations relating to this point are first, that when any part of the body has been exposed to the stream of electric fluid it acquires a sulphurous or rather a phosphoric smell which it retains for a considerable time; secondly, when the stream of electric fluid, issuing from a point, is directed toward the palate, a kind of acid taste is perceived.

Now this smell and taste indicate that the electric fluid either alters the parts of the body upon which it excites those sensations or that it carries along with it some other principle which may perhaps be separated from those substances through

which this fluid passes previous to its impinging upon the body.

Whether these effects may be increased, diminished or turned to any use, and also whether they are quite indifferent with respect to medical electricity, are matters that require further experiments and consideration. In various experiments when the electric spark is passed through air or other fluids, especially in the case of tinctures of certain flowers, it shows effects similar to those which the inflammatory principle or an acid produces upon those fluids. The facts have induced various persons to suppose that the electric fluid is phlogiston or an acid, or else a compound of both. But considering that in those cases the action of the electric fluid as an acid or as phlogiston is exceedingly small, and also considering the violence with which it passes through the substance of bodies, the surface of which it usually burns or melts in a small degree, it seems more natural to suspect that the above-mentioned effects are produced by that quantity of inflammable or acid principle which the violent passage and escape of the electrical fluid detaches from other bodies rather than to consider electricity itself to be an acid, which seems to be very unlikely on various other accounts.

It is customary in this age of aggressive bacteriology to discredit the "quacks" (*sic !*) who were the pioneers in electro-therapeutics, but that Tiberius Cavallo, F. R. S., was a scientific and discriminating observer and not an ignorant empiric is evident from the mere list of his literary productions which is affixed.*

* 1. "A Treatise on the Nature and Properties of Air and Other Permanently Elastic Fluids; to which is prefixed an Introduction to Chemistry," 4to, with plates.

2. "The History and Practice of Aërostation," 8vo, with plates.

3. "A Treatise on Magnetism in Theory and Practice with Original Experiments," 8vo, with plates.

4. "Two Mineralogical Tables with an Explanation and Index."

5. "Description and Use of the Telescopical Mother-of-Pearl Micrometer Invented by the Author," 8vo.

6. "A Complete Treatise on Electricity in Theory and Practice, with Original Experiments" in three volumes.

About a hundred years later a French writer, Dr. A. Arthius (1871), summed up the physiological effects of static electricity as follows:

It induces an acceleration of the pulse, it is singularly *calmant*, eases the respiration, develops animal heat, augments cutaneous transpiration, makes more active the urinary secretion, disperses nervous irritation, and gives tone to the whole organism. It is the great dispenser of equilibrium to the disturbed balance of the system, it increases the vital forces, and augments the energy of absorption. In a word, it excites and facilitates the play of all the functions. It is regarded by those who use it as the greatest regulator of menstruation. The well-being which it instantaneously produces causes those who have once experienced it to wish for a repetition of its beneficent effects.

When, one hundred and forty years ago, it was discovered by the Abbé Menon that the human body loses weight by being continuously electrified for five or six hours, he attributed the loss to the increase of insensible perspiration and tissue change. We now say about the same thing in somewhat different language.

The teachings of modern investigation upon this subject may be fairly stated in the following terms: Static electricity increases the excretion of urea, and lessens the uric acid in the system by promoting oxidation. It increases both the appetite and the body weight when the latter has been reduced by impaired nutrition. It lowers the blood pressure. In ten to fifteen minutes of general electrification, or a few minutes of sparks to the spine, a gentle perspiration ensues, accompanied by a feeling of well-being. When this reaction has been reached the sitting may be ended for the day, in ordinary treatment.

Under the influence of static electricity the heart-beats undergo a change, viz., if slow, they may increase ten to twenty beats per minute; or, if too fast, they may be reduced in number. It tends to regulate functionally deranged temperature. Many cases of neurotic, neurasthenic and melancholic conditions are found to have subnormal temperatures (97° to 97.5°

F.) before electrification. These states it adjusts to normal, and the patients then usually improve.

The static spark causes groups of muscles to jump. It is a most powerful stimulus to nerve and muscle function, and rapidly imparts tonicity, lightness, buoyancy, and firmness to soft, lax, and enfeebled muscular substance. It first causes a vasomotor constriction, blanching the skin. This soon gives place to a dilatation, and the spot gets red. Frequently a wheal is raised, with a temporary sense of tingling and irritation, which will quickly pass away or be instantly removed by rubbing the part with a little toilet powder. If sparks are applied with sufficient persistence to the same area, a mild papular eruption will often be caused.

Devoid as it is of electrolytic action, the power of static electricity seems to be chiefly manifested as a regulator of *functions*. It tends to adjust to normal action the heart, respiration, pulse, temperature, oxidation, secretion, excretion, nervous irritability, and sleep. It increases metabolism so that a person can absorb more oxygen: and this mere improvement in nutrition is a vast power for good, and alone suffices to correct many morbid states: as gout, rheumatism, neurasthenia, neuralgia, anæmia, and various symptomatic derangements.

The spark, by its powerful mechanical disturbance, sets up a great molecular change and acts as a stimulating massage. It thus affects the nutrition of a part, disperses exudation material, and promotes absorption. Thickenings of joints, tendons, and muscles, localized œdemas, effusions, etc., are reduced by strong, thick static sparks.

With fine, rapid, frictional sparks may be obtained the beneficial effects of counter-irritation upon the skin; and with a special electrode a blister may be created in from one to four minutes, if desired.

Sedative or stimulating effects are equally under the operator's control, and may be obtained at will.

Many varieties of pain are promptly relieved by some form of static electricity; and if not due to an incurable or persisting cause, it is wellnigh certain that the pain-killing property of this agent will give permanent relief, if treatment is persevered in long enough.

As a concluding summary of modern opinion upon the action of static currents, I will repeat here an abstract of the report of the committee on "Standard Electrostatic or Influence Machines" presented to the convention of the American Electro-Therapeutic Association, and published in the *Times and Register*, December 29th, 1894:

The committee stated that the report was one of immense comprehensiveness and could only be scratched on the surface in the short time allotted. The physiological effects of static electricity are pretty much all that are produced by all electricity. It sets free the potential energy of the cells of the human organism. That is, it excites the cell in such a way that its inherent energy is liberated. Its wide range of effects vary with and depend somewhat upon the manner in which it is applied.

It causes contraction of the protoplasm, both animal and vegetable. It excites nerve fibres, nerve cells, and nerve centres. All of them are excited to functional action and caused to produce their separate effects—motor, sensory, special sense, secretory, sympathetic, vasomotor, etc.

It has a mechanical action. It disturbs the molecular arrangement of tissues and causes a new structural arrangement, resulting in modifications of nutrition.

It has a cataphoric action and can be made to transfer metals and convey medicaments into the tissues.*

Its general effects are of great range and astonishing importance. They may be briefly stated as follows: It promotes nutrition of every part it excites; produces marked local and general circulatory effects, and stimulates the vasomotor nervous system. It promotes metabolism and tissue metamorphoses; creates a feeling of refreshment to the system; causes the reabsorption of exudation material of a chronic nature and has a revulsive action upon the skin. It is both a cutaneous sedative and counter-irritant, and

* In 1872 Arthuis described metal transference and advocated the use of silver, iron, and other metals in the usual electrodes. Practically no use is made of this suggestion.

makes a powerful peripheral impression of great value in neurasthenia.

The subject of reflex pains is of constant interest to a physician. Pains are often referred by patients to points distant from their origin. Possibly a pain travels along the path of least possible resistance, and in its outward path it prepares the way for the return of a curative influence along the same path. No matter how far from the local irritation a reflected pain may manifest itself, spark the sore place and the impression will track the pain to its seat and drive it out. We cannot cure altered structure, but we can correct functional pains, and often relieve organic pains by setting up powerful ingoing impressions and displacing the pain.

The list of diseases in which static electricity can be beneficially employed is a long one. Its great fields are nervous and functional conditions. In cases of malnutrition it is an excellent tonic. Neurasthenia, hysteria, neuralgia, nervous headaches, etc., are rapidly controlled by it. In cord diseases it affords relief from various forms of pain, even when lesions are advanced beyond cure. It is invaluable in muscular rheumatism, chronic synovitis, and chorea. It is one of the best general tonics we possess, and as such is easy and agreeable of application, and can be used in a great variety of cases. In the treatment of paralysis of curable forms it is one of the most successful agents we have.

It should be noted, however, for the better understanding of those who are not practical electricians, that these interesting effects attributed to static electricity are neither invariable nor absolute, but depend upon and are influenced by concomitant conditions, just as drug action varies under different circumstances. For instance, in a cold office, and with a patient with habitually cold extremities and lack of vital warmth, we may discover little sign of the perspiration spoken of. It may therefore be stated that the demonstrable physiological effects upon any given case will be modified by the individual idiosyncrasy of the patient, the apparel worn, the state of atmosphere in the room, the electrical output of the machine, the method by which it is applied, and the duration of the sitting.

The great electro-motive force of this current gives it almost unlimited power of penetration, accumulation, and diffusion. When the machine is in action and we interrupt the continuity

of the output by a series of sparks anywhere upon the conductor, every particle of atmosphere in the room is thrown into vibration, and vibration is set up in the tissues of the patient. A person now seated upon the platform may feel with his extended hand the atmospheric commotion synchronous with the passage of each spark, and the person's hair, if sufficiently long, will exhibit the same oscillations to an observer. If we imagine every nerve fibre and blood-vessel in the electrified subject undergoing the same intense oscillatory stress, we can readily understand one aspect of its effect upon circulation and nutrition.

It was formerly the fashion to call in question the penetrating capacity of the static current and to claim that its action is limited to the surface of the patient's body. It is curious to see how such a contradiction became so deeply rooted in the literature of electro-therapeutics, for a very simple argument will prove the reverse.

This argument may take several forms, of which it is sufficient to present one, viz.: It is not claimed that galvanic and faradic currents pass only on the surface of the body between two applied electrodes. It has long been admitted that they both penetrate into the tissues beneath the skin. The resistance of the air, however, is so infinitely greater than that of the skin that neither galvanic nor faradic medical currents will pass between two conductors separated by an air space of an inch or any appreciable portion of an inch. Now, it is well known that the static discharge will pass through several inches of atmospheric resistance; and if a patient be seated upon a platform at the usual distance from a Holtz machine, but without any conducting attachment to it, he will be sufficiently electrified to yield a perceptible spark. I have frequently measured the distance at which the breeze from a point electrode can be felt, and found it to be upward of forty inches. Metallic bodies, thirty or more feet removed from an operating machine, are influenced.

After witnessing this exhibition of a power of overcoming resistance so enormously surpassing the power of either current which admittedly penetrates within the human body, the theory of surface limitation is difficult to maintain. A rifle bullet that will pierce steel armor will hardly be stopped by a wooden shingle.

Moreover, the original theory of surface action started from the physical laboratory and had no relation to action within human tissues.

When we consider the countless evidences of high potential, the spark, the excitation of a Crookes tube which neither the galvanic nor medical faradic battery will even glow, and the vigorous muscular contractions set up by the interrupted static current, we have only to wonder that the curious transposition of fact regarding its self-evident voltage was ever allowed to find its way into print.

Leyden-Jar Currents.—The physiological actions are along the same line as the actions of improved high-tension induction coils.

It is often stated that this form of static current is in fact superior to any coil. It is also sometimes stated that every application of faradic currents can be duplicated by Leyden-jar currents. In practice these opinions are not quite true.

Without taking into account any exact difference of maximum potential between coil currents and Leyden-jar currents (for the medical dosage will always be regulated to the case in hand), it is proper to say that a slowly interrupted current from either an improved coil apparatus or Leyden jars will do about the same therapeutic work. If a common faradic battery is in question it must be stated that the Leyden-jar current outclasses it entirely in every respect; but that is because the common faradic battery is an inferior appliance and should be no longer considered as a therapeutic instrument.

When we take into consideration a very rapid interruption of the current, then the finer coil apparatus (such as the au-

thor's) presents some qualities which the Leyden-jar currents lack.

Both rapid and slowly interrupted Leyden-jar currents are adequate for all therapeutic applications upon the surface of the body which relate to ordinary nerve and muscle effects. But if the physician will test the splendidly even and smooth action of the rapid vibrator current from my induction-coil apparatus by the bipolar electrode held in the hand, and by a telephone receiver held to the ear, and then make the same tests of the finest Leyden-jar current that can be obtained, he will discover that it is inferior for sedation effects upon inflammatory tissues and especially for employment within the pelvis. It is manifestly too rough and ragged, and is interspersed with secondary discharges, and an unevenness which is inseparable from the manner in which the static current is produced. It may be used within the pelvis in subinvolution with slow interruption, but I would not consider it suitable to gynecological practice with the bipolar electrode for sedative effects.

Leaving this branch of work aside, therefore, and considering external applications for the most part, it remains to say that the well-understood physiological actions of coil currents differ in no respect of importance from Leyden-jar currents.

When a slowly interrupted Leyden-jar current stimulates a motor nerve it causes a muscular contraction. This contraction will be more powerfully manifested at the negative electrode when both are of equal size.

The electrodes employed with Leyden-jar currents may be either bare metal or covered with sponge or felt, and do not differ from those employed with faradic currents. They are attached to the terminals of the machine by the usual conducting cords, and although a pair of extra long hard-rubber handles is usually furnished with the machine, they are a luxury rather than a necessity, for any handles, or no handles at all, will serve the purpose.

It must also be said that the single pair of sponges which

are the regulation equipment of every machine are but the most primitive beginning of a full equipment of assorted electrodes which the physician will require if he attempts to employ Leyden-jar currents for all the purposes of faradic currents.

If the plates of the machine are revolved very slowly, and periods of less than one hundred per minute are regulated in current strength to a therapeutic dose, the contractions of muscles set up by this means will alternate with relaxation and rest, and the nutrition and strength will improve. This is the way to restore the function of a partly paralyzed muscle.

If the plates are made to revolve faster so that the frequency of interruption will be several hundred per minute the muscles cannot relax and rest, and the current strength, which was comfortable before, will now be unendurable and quickly produce fatigue and pain, for the muscles will be overworked unless the current strength be reduced to tolerance.

If, however, the plates are made to revolve still faster so that the periods will be somewhat increased and the current strength reduced to tolerance by reducing the spark gap, an excellent gross-massage effect will be produced by passing the roller electrode over the surface of the body.

If the rate is doubled and the method of general faradization is employed, the same effect will be produced with the Leyden-jar current as with the induction coil, and if the periods are now made very fast and the current strength adjusted to produce a comfortable thrill over the surface and mild contractions over motor points, a general tonic administration will be made which will combine circulatory and vasomotor effects with nerve and muscle reaction.

The physiological effects of Leyden-jar currents are not varied in their specific nature by different individual properties of small, medium, or large jars. The academic discussion of Leyden-jar discharges, and whether they cause "painless" or "painful" muscular contractions, does not demand serious attention. I have never read anything on the subject which was not con-

fusing to the novice or filled with erroneous statements. Any physician can connect a pair of jars of any size and test different regulations of length of spark gap and rapidity of interruptions for himself, and five minutes of such information will be worth more than all the discussions that have so far been reported.

The fact is that the *maximum* capabilities of current condensation differ with the surface area of each size of jar, and a large jar has a greater capacity than a small jar; but as it fills up from the same electric source with exactly the same current and is never employed in medicine except with an exceedingly small fraction of its utmost capacity, it follows that any expert operator can regulate a desired dose so that no blindfolded person can tell what size the particular jars in circuit are.

When any Leyden-jar current is properly regulated to a medicinal dose and is interrupted with a maximum of rapidity, it is a high-potential, high-frequency current, and develops the physiological effects attributed to such currents. These are described fully in another chapter.

They unite upon nutrition the good effects of exercise, warmth, increased blood supply, and fine vibratory massage. They are circulatory, muscular, and nerve stimulant, tonic or sedative, according to the manipulation and dose.

The patient must disrobe sufficiently for the purposes of a given application, and moistened electrodes must be placed in direct contact with the skin. One or both of these electrodes may be held stationary or moved about, but as the methods are similar to faradic therapeutics I need not describe them, but will refer only to the action during the passage of the current.

It is possible to secure the following physiological effects from rapidly interrupted Leyden-jar currents: They contract blood-vessels as well as muscles, increase peristalsis in all non-striated muscular fibre, stimulate every part of the nerve, whether cell or fibre, excite nerves of special sense, quicken the

circulation and glandular secretion, combat blood stasis, relieve congestion, and promote the absorption of effusions and the eliminations of products of waste. The processes of oxidation are quickened, the elimination of urea, carbonic acid, and water is increased, and incomplete food combustion is more completely carried on.

When these rapid vibratory impulses are directed with the flow of the blood current they reinforce the vermicular movement of arteries and the functional activity of nerves. In the reversed direction they retard the normal current through blood-vessels and nerves.

These currents relieve pain in the same manner that induction-coil currents relieve pain; they are useful to every possessor of a static machine; but in practice they are very seldom employed. The portability and convenience of the smaller and eminently satisfactory high-tension induction-coil apparatus as shown in Fig. 2 gives it a certain superiority for practical work which the Leyden-jar current does not possess. The theoretical merits of the latter are not denied, and by any physician who possesses a good static machine and only a poor faradic battery the Leyden-jar currents should be preferred.

Owing to the fact that it would be a work of supererogation to repeat in this part the entire therapeutics and technique of faradic currents, I have deemed it sufficient to set forth the chief physiological actions and leave those who wish to employ Leyden-jar currents therapeutically to pursue the faradic methods with which they are already familiar. There is no difference worth speaking of in the technique. There is, however, one other important reason why they are so seldom employed when their merits are admitted. To the man who possesses no static apparatus the coil current is the only alternative. But the physician who already has at hand the source from which

his Leyden-jar currents would be obtained if he desired to use them, has other applications available which dispense with the removal of clothing, and which not only do many things that the Leyden-jar currents cannot accomplish but include within their sphere of action almost the whole practical range of utility belonging to the more troublesome method.

CHAPTER XII.

STATIC METHODS—PRODUCTION OF SPECIAL EFFECTS.

Arrangement of patient on the static platform. Management of accessories. Positive electrification. Negative electrification. The author's method of potential alternation. Positive static breeze. Negative static breeze. Positive or negative static spray. Massage roller applications. The static cage. Positive static sparks, frictional and percussive. Leyden-jar currents. General sedative effects. Local sedation with the static breeze. General stimulation effects. Local stimulation with the static breeze and spark. Static polarity effects. Counter-irritant applications. Nutritional applications. Muscle contracting methods. Massage, electrical and hand.

In general, the methods of employing static electricity are in marked contrast to the applications of other currents. Instead of placing certain tissues, or portions of the patient's body, between two electrodes, and affecting chiefly or only the included parts by employing a current with a direct circuit flow and little or no lateral dispersion, we transform our entire patient into one great electrode by seating him upon the insulated terminus of the acting pole of the machine, producing a complete general electrification, which constitutes the basis of all static treatment. Upon this all local applications are grafted. The other pole is usually connected with the earth and disregarded in general treatment.

When the machine is started into action a separation of the collected electricity into positive and negative takes place. Each dissociated portion of the electric force, being self-repellent, strives to escape from the enclosing case of the machine by a separate channel, and the result is a continuous flow from the higher to the lower potential. The flow from one half of the revolving glass plates is carried off to the earth by the chain attached for this purpose to the unused conductor, while that from the opposite half of the plates is conveyed by a conducting rod or chain to the insulated platform, where its downward flow is headed off and a remarkable phenomenon takes place. Unable to pass down the glass supports of the platform to reach the great negative magnet the earth, the swift output

of the machine *accumulates* like a fast-rising flood, escaping upward and outward at every point where the tension of insulation gives way. The accumulation from a powerful machine is thus sufficient to form a great electric pool upon the platform, in which the patient is invisibly bathed, becoming electrified with the same potential as the prime conductor to which he is attached; and he is charged everywhere alike throughout every tissue, filament, and fibre of his body, for it is a law in electrics that "the potential inside a conductor has the same value as at any point on its surface."

There is no clothing to remove, no current direction (ascending or descending) to take into account, and no rheostat is required to govern the current strength of general electrization.

The individual upon the platform is simply permeated from foot to head, not with a galvanic streak shot through him from point to point, but by an electric force of illimitable dispersive power, and a penetrating energy that laughs at the resistance of the human tissues.

Without *accumulation* there could be no therapeutic employment of static electricity, owing to the small quantity of the current stream. To illustrate this, we may stand the patient upon the floor instead of the insulated stool, and place the hand upon the conductor as before.

The current now flows through the body to the earth at its normal rate of strength (quantity), but no crackling sound is heard as it escapes, no hair stands erect upon the head, and the spark from the largest ball electrode is so small and feeble that, to obtain it, the electrode must be held within about half an inch of contact. Various tests of this kind may be made by each operator for himself, and by personal experimentation alone can the physician become intelligently familiar with every phase of action of the static machine.

In placing the patient on the platform it is necessary to see that the dress does not drag on the floor at any point to leak off the current.

For practical treatment any ordinary wooden chair with or

without a back may be employed. A simple cane-seated stool is necessary for general purposes. The chair may be any form, rocker, reclining or upright, and may be seated with cane or leather, but must be devoid of all metallic ornamentation, such as fancy-headed nails around the edge. An ordinary steamer chair is also exceedingly useful when one is treating a feeble patient who finds an erect position tiresome.

To obtain effects which are both pleasant and beneficial, a certain degree of care and experience is required, for, unless properly administered and with due regard to circumstances, static electricity is liable to prove disappointing. It may even be made exceedingly disagreeable ; nay, it may be intolerable in the hands of a careless bungler. A great part of the expressions of appreciation, pleasure and satisfaction elicited from patients is due to the judicious use of the various electrodes.

The great variety of effects obtained from static currents are to be produced by the great variety of practical manipulations of current strength, conditions of treatment, and a few essential electrodes, rather than by multiplying the number of electrodes.

The traditional umbrella crown electrode is superseded by a small group of pointed and fine wires bunched together. This produces a concentrated head breeze instead of the diffused scattering of the current caused by the umbrella. As a practical electrode the large, clumsy, but time-honored umbrella is contrary to the established principles of therapeutic breeze application.

The improved platform of to-day is the most essential accessory accompanying the static machine. The ordinary size is forty-two inches long by twenty-seven wide and is supported a foot above the floor by solid glass legs. All corners and edges are rounded. The early, square-edged, sharp-cornered platforms, with wooden legs set into common glass cups, leaked off a large amount of current, and are obsolete. All who are still using such an inferior platform should procure a better one. I

have seen men who deemed themselves very experienced with static electricity still use one of these worthless and long since rejected platforms, without realizing that they were wasting half the current that should have reached the patient. A good platform that will insulate the patient effectively is a cheap investment and an absolute necessity.

The author's insulated electrode handler is also a practical requirement for the physician.

Another extremely important accessory part of the static machine is the means of connecting the Leyden jars with the prime conductors. In one of my former machines these hooked directly upon the pole piece, and the hard-rubber supports for the sliding rods were solid at the base, and allowed little leakage. My present apparatus, however, was fitted when first purchased with a jointed rod device, and instead of being solid, the hard-rubber knob beneath each pole piece was open at the bottom and fitted with a brass screw, into which the jointed rod was secured. The result was found to be a leakage so great as to be fatal to X-ray work with tubes of high resistance, and to reduce the therapeutic efficiency of electrification by at least one-fourth.

So great was the leakage that it was impossible to procure between the sliding poles the splendid luminous displays and "fox-tail" or whisk broom, which ought to be visible at the positive pole in a dark room. It is wise to speak of this point because a number of physicians may be employing a similarly constructed apparatus without suspecting the reason why they cannot equal reported results. This defect has since been corrected, and can be rectified upon any apparatus of this kind in use.

Physicians accustomed to the administration of electric currents created by chemical action are somewhat confused when they first attempt the different applications of static electricity, which will now be explained in detail.

Positive Electrification.—Seat the patient upon the platform, with the platform related to the machine so that the brass

rod will conveniently reach from its nearest side to the prime conductor.

It should not be under a gas fixture, or within a couple of feet of other office furniture, and as a general rule the more free room around the platform the better.

The side of the patient nearest the machine should be two feet or more from the grounded pole, or otherwise a strong current, woollen garments, and the negative attraction may annoy the patient with an irritating breeze.

In hooking the "shepherd's-crook" rod over the positive pole it should be hooked with the ball extremity uppermost, and close up to the large ball of the prime conductor, to prevent leakage. It is usually thrown over the rod in a careless manner with the ball projecting downward and toward the machine. This is a bad method and wastes the current. The "crook" at the end of the platform rod should be bent for practical use until the ball and the neck are within an inch of each other. As usually furnished by makers it is an ornamental but not practical shape.

Hook upon the negative pole of the machine the free end of the brass chain which has already been linked to the copper wire passing from the baseboard to the water pipe or gas fixture. This grounds the negative pole.

Place a metal foot-plate, or tray, under the patient's feet, and connect it with the lower end of the platform rod by a piece of chain attached to it for this purpose.

In this application, and at all times whenever any ordinary form of treatment is given upon the insulating platform, the sliding poles of the machine are to be drawn their full width apart. They are only brought near together when Leyden-jar currents are employed.

Next, start the machine into action and cause the plates to revolve as rapidly as they can without either racing or sparkling within the case.

In dry, wintry weather a highly insulated positive pole will sometimes drive sparks between the metal parts within the case

and startle a timid patient. Reducing the speed of the machine will avoid this, but it should be remembered at all times that simple general electrification requires a maximum current strength for maximum beneficial effects.

If no local or other application is made at the same sitting, positive electrification is usually maintained about fifteen minutes, but often requires a longer time for full effects.

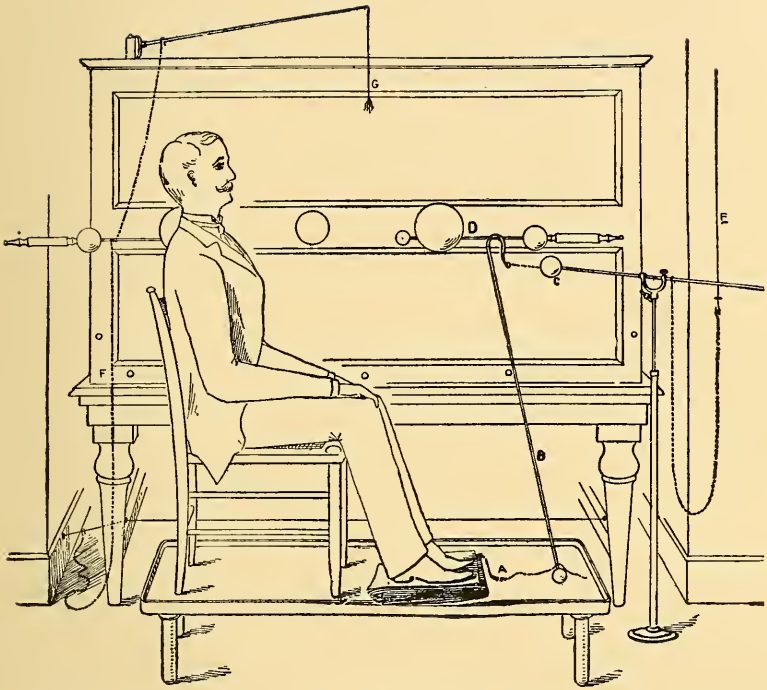
Negative Electrification.—Each step of the process exactly repeats what was done for positive electrification except that the rod is hooked to the negative pole and the grounding chain is hooked to the positive. The machine rarely sparks back with this low potential polarity, and the patient may either sit with feet upon the tray or hold the rod in her hands, while a maximum current is maintained. There is no liability of causing irritation through woollen garments by the attraction of neighboring objects.

Potential Alternation.—The above two methods are a continuous general electrification. Potential alternation, as described by the author in 1893, constitutes an interrupted and oscillating, vibratory, general electrification. It may be considered as adding force to the continuous current, something as a hammer blow adds force to continuous pressure, and is a more energizing tonic than the primary method.

Either remove the patient's shoes and place the stocking feet upon a reservoir electrode filled, for comfort, with warm water, or, if this is too much trouble with high-laced shoes, leave them on and insulate the nails in the heels by putting three or four folded newspapers between the shoes and the metal footplate.

If shoes are worn without such protection the interrupted current will pass up the nails and through the soles of the shoes, in a succession of sparks, and the tolerance of the feet would not permit the current to be made strong enough to affect the rest of the body.

Next prepare the platform rod the same as for simple positive



Potential Alternation. *A* chain from rod *B* to positive pole *D*. Patient's feet are protected by several large electrical journals placed over the brass tray. *C* is the ball electrode placed upon the standard and grounded by chain to wire *E* passing to gas fixture. The opposite grounding chain *F* connects the negative pole with the head-breeze electrode *G*, grounding both. *G* is about three feet distant from the patient's head. The dotted lines between *C* and the terminus of the shepherd's crook indicate the spark gap interrupting the current when the machine is in rapid action. The usual length of this spark gap is from four to six inches.

electrification, and ground the negative pole. Fix the large brass ball spark electrode upon the movable standard and place it beside the positive prime conductor so that the balls of the electrode and the "shepherd's crook" will touch each other. Ground the electrode to the gas fixture if the negative pole is grounded to the water pipe. Different groundings in this case are essential.

Over the head of the patient arrange the head-breeze electrode, and attach to it the same chain which connects the negative pole to the water pipe. Adjust the head electrode so that it shall be about three feet distant from the patient.

Start the machine into rapid action and gradually draw the ball electrode away from the shepherd's crook so that finally the length of spark which passes between the two will cause a gentle thrill that does not exceed comfort in the patient's feet; at the same time, vigorous oscillations will be seen in the patient's hair.

The operator may use a single hand to move the spark electrode. Never touch the standard with both hands while the long spark is passing.

The patient must keep both feet flat in contact with the platform. If one foot is lifted the density doubles as the contact area is divided, and hence a current strength that is proper for this treatment might be exceedingly disagreeable if concentrated upon one foot.

I am often asked what should be the length of spark between the interrupting electrode and the positive pole. Spark lengths will vary according to conditions, and the dose is not regulated by inches. Oscillations should be obtained which will set the atmosphere and hair of the patient in that degree of powerful commotion which, in a given case, experience demonstrates to produce the most sedative-tonic effect. As a matter of fact the spark streams, which I have often measured to gratify inquiring physicians, have varied from three to seven inches in length, with an average, probably, of about five.

The same method can be pursued with the negative pole, but the high potential polarity is more effective and hence preferable.

Positive Static Breeze.—Arrange patient and machine attachments the same as for negative electrification, and ground the positive pole to the wire near it, which has previously been brought from the gas fixture to a situation near the machine, convenient for this purpose.

The breeze may apply a continuous or an interrupted current and the electrode may be in motion or stationary.

For a stationary breeze upon the head, forehead, occiput, joint, or any localized part of the spine or body, fix a brass point electrode upon the standard and set it at a proper distance from the part to be treated.

For a vertex head breeze, simply swing out the hinged rod screwed upon an upper corner of the case of the machine, and suspend the small bunch of wires, elsewhere alluded to, over the patient's head—twelve to twenty-four inches, according to the thickness and resistance of the patient's hair and the effect desired. For this purpose my own special head-breeze electrode consists of half a box of exceedingly fine, French gilt hairpins which I wound together at the top with a small piece of wire, flared the points slightly apart, and suspended them by a foot of copper wire to the extremity of my swinging rod.

When all is ready ground the electrode to the gas fixture and start the machine into action.

Regulation of speed, distance from point to patient, length of application, and all that constitutes the dose, depend upon the therapeutic indications and call for operative skill on the physician's part.

A moving positive breeze is administered by attaching the brass-point electrode to a chain, hooking the chain to the gas fixture, and manipulating the point with rapid or slow sweeping motions, at greater or less distances, over a given part, according to the effect desired.

To apply either a stationary or moving breeze in the most effective manner the method taught by the author of interrupting the current before it gets to the patient is superior to the method sometimes employed of interrupting the breeze on its way to the earth. This latter method adds no efficiency to the treatment, although it will eliminate the irritation of a negative head breeze upon a thick head of hair, or through woollen garments upon other parts of the body. The author's method, however, not only eliminates negative irritation, but tremendously accelerates the current force with which the patient is electrified. This is one of the rudimentary things I demonstrate to all my students. All other steps of the process are the same as for a continuous breeze.

To cause the interruption the patient holds the platform rod in her hands, rests the crook conveniently upon the frame of the case, in such a way that the rod can be steadily and easily held at the distance of an inch, more or less, from whichever prime conductor is chosen for the treatment. A spark stream will pass between the pole and the rod as soon as the machine is started into action. The plates should revolve quite rapidly, and by increasing or decreasing the spark gap, the interruptions may be made either slower or faster, milder or more vigorous, and the intensity of the treatment regulated. Further regulation is attained by varying the speed of the plates and the distance between the electrode and the patient.

Negative Static Breeze.—All that has been said about the method of applying the positive breeze equally describes the negative breeze administration, except that the high potential positive pole must be connected with the platform. Electrodes are grounded and manipulated in the same way as before, with only such differences as the more irritating qualities of the strong negative breeze through resisting garments require. It is not irritating through cotton fabrics or on bare skin.

Positive or Negative Static Spray.—Spray applications simply intensify either the continuous or interrupted static

breeze by throwing from the point of the electrode manipulated by the operator a convective shower of visible electrified particles of air.

For this purpose the electrode must be swept sufficiently near the patient, and the development of all the useful sedative, tonic, stimulating, counter-irritant, and rubefacient effects of which this method is capable calls for familiarity with the physiological actions of static electricity, and considerable experience and operative skill.

Massage Roller Applications.—The regulation of intensity and muscle effects with this method depends upon the distance between the two sliding poles, which are first brought near together and gradually drawn apart to increase the current strength.

The electrode is connected to a chain in the usual manner. It may then be employed with the following variations:

1. Attach the chain to either the negative or positive pole, apply the electrode to the insulated patient, and ground the opposite pole.

2. Connect the platform and the machine with the rod as usual, and attach the electrode to the opposite pole, which is also grounded.

In the above applications the selection of poles is the same as for the static breeze. If the patient is connected with the positive pole its higher voltage gives greater intensity and heating and counter-irritant effects.

The poles may also be drawn wide apart and the electrode manipulated by the patient over the affected part while the operator interrupts the current with the spark-ball electrode upon the same prime conductor.

The roller may be also used with the Leyden-jar current by placing the bare feet upon a foot-electrode connected with the negative Leyden-jar while the operator passes the roller over the surface of the body. In this case the roller is connected with the positive Leyden-jar and the strength of the

application is regulated by the distance between the sliding poles.

These applications are nearly the same as the short frictional spark when counter-irritant effects are produced, but can be made to equal a slowly interrupted current to exercise muscles in a manner similar to massage.

The Static Cage.—This, when brought to general notice by descriptions in medical journals, has excited the interest of physicians, who presumed it to be either a new method or a method producing exceptional and superior effects.

The application of the static breeze to the head and spine, or entire body, by a breeze electrode fixed above the patient upon a standard, or by the brass point electrode manipulated near the patient by the hand of the operator, is about as old as the static machine. It has been practised nearly a hundred and fifty years. It is a utilization of the law that opposite electricities attract each other, and is a means of increasing the rate of change in the patient's positive or negative charge, or of localizing the area of diffusion from the entire body to a part upon which effect is concentrated.

When the point electrode is held near any part of the body it rapidly attracts off the insulated patient's electric charge, and is felt as a breeze upon the surface ; and when the principle of the point as an attracting magnet is amplified by multiplying the number of points, arranging them in a circle surrounding the patient's body, or suspending them like a canopy above the reclining person, the result is a diffused breeze upon a large area instead of a concentrated breeze upon a small area.

When this method was first brought to my attention in 1894 it was stated to involve a process of auto-induction ; inductive currents being set up in the patients body by the surrounding "solenoid." A single personal experience disclosed at once the error of this view and revealed the cage as simply an expanded breeze electrode. Those who wish to make one can

easily do so at a small expense and use it when it may serve. No exaggerated value can be attached to it, but it lends variety to methods which accomplish about the same result.

The indications for its use are general functional neuroses and diseases associated with perverted nutrition.

It is constitutional rather than local treatment and adds rapidly to the rate of change (current flow) of general electrification.

The cage may alarm very timid or hysterical subjects, and may be inconvenient to use upon some others. It is best adapted to men, or young girls or women who are rather trimly-dressed, and who can easily stand within the cage in the required manner during the ten or more minutes of the application.

The effects parallel those attributed to high-potential currents of high frequency by French investigators during the past four years. The expert can vary the cage application in a number of ways, and interrupt the current by approximating the sliding poles, or by the author's method of potential alternation. In ordinary hands, however, the methods which are simplest and serve every purpose are the following:

1. Negative electrification with either constant or oscillatory positive breeze.

2. Positive electrification with oscillating breeze.

Have the patient remove shoes and stand in stocking-feet upon the reservoir foot-electrode, which should be filled with warm water as a matter of comfort, for a cold foot-plate is disagreeable to most persons in cold weather.

From this electrode, connection is made to the platform rod and prime conductor of the machine. The rod is placed upon the platform in the usual manner. The cage is now lowered over the patient so that he or she stands in the centre, with a distance of about six inches between the top of the head and the chains suspending the cage.

The prime conductor not connected with the platform is both grounded and connected with the metallic cage by the usual

grounding chain, passed first over the sliding pole and then hooked to the cage.

The sliding poles are short-circuited, and the machine is now started into action. The poles are next drawn apart about one inch. The exact distance is regulated by the sensation in the patient's feet, which should not exceed an entirely comfortable thrill. If drawn too far apart the spark stream will cease to pass between the poles, and this fact also requires that they should be kept near together.

This constitutes the oscillating breeze, and may be administered for five, ten, or more minutes, according to the operator's judgment. The technique is the same with either pole. With the negative charge it is bland and cool; with the positive charge it is more irritating or stimulating if garments make it so, but both can be made agreeable to the patient.

It is well to test the milder negative electrification first, as patients may be so dressed that the positive charge and negative breeze are too irritating to the skin beneath their garments. This is most likely to be the case with loosely woven, woollen fabrics, metallic hairpins, metallic dress trimmings, and corset steels, and no one should treat a patient with the negative breeze until he has familiarized himself with the sensations set up by different dress goods of higher or lower resistances. The removal of the outer coat often corrects the trouble.

The oscillatory application requires the passage of a stream of interrupting sparks between the prime conductors of the machine and is the most effective tonic manner of using the cage. The author's method of potential alternation, however, practically furnishes the same effect in a simpler way and obviates the necessity of employing the more troublesome electrode.

To produce a simple breeze it is only necessary to draw the poles apart at the beginning instead of sliding them together. The current is then continuous instead of interrupted, and does

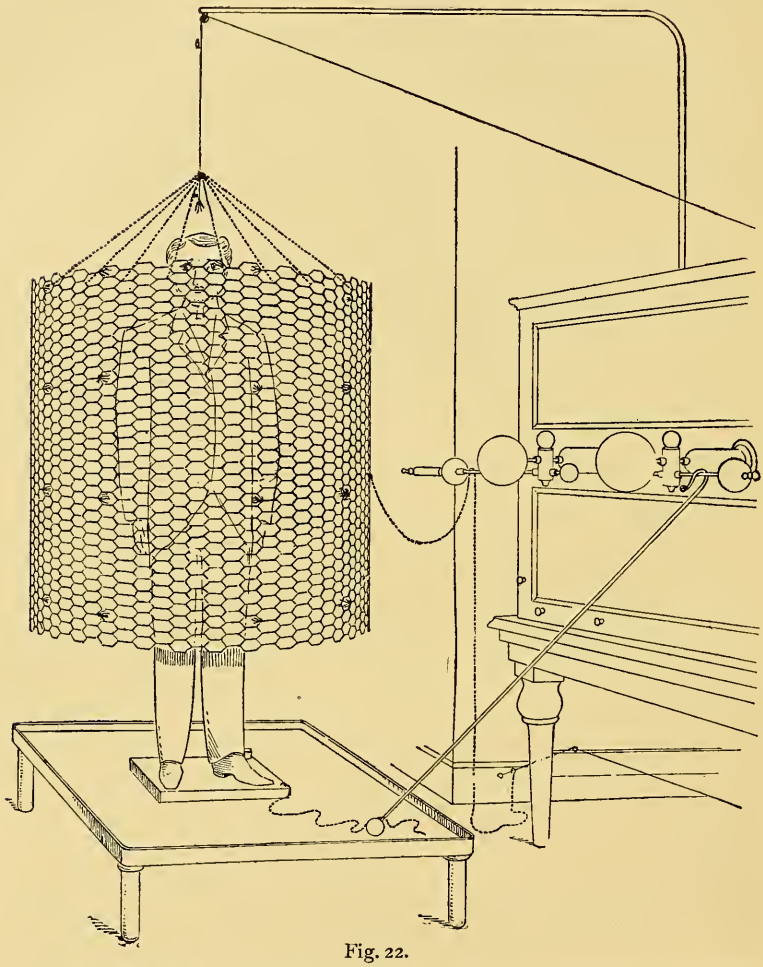


Fig. 22.

The Static Cage. This diagram shows the author's apparatus with great completeness. The patient stands upon the metallic foot-plate filled with warm water and connected by a piece of brass chain to the rod passing to the pole of the machine. The opposite pole is grounded and the same chain is hooked to the cage. The cage is suspended upon the frame and is raised and lowered by the stout cord passing through the pully. When not in use the cage stands upon the top of my static machine. The patient may sit upon a stool if desired. The cage may be adjusted to any height.

not differ, except in the size of the electrode, from any other continuous static breeze.

The cage is a "general-electrization" method, and applies to the usual range of cases in which static electricity is of recognized benefit, particularly functional nervous disturbances, and is a sedative or stimulating tonic. It is not especially suggested in the therapeutic, itemized paragraphs of this book, for the reason that few possess the appliance, and those who do can readily comprehend its uses and employ it as opportunity permits.

Positive Static Sparks, Frictional and Percussive.—Arrange patient and machine attachments the same as for negative electrification and ground the positive pole to the conducting wire from the gas fixture, or to the chandelier.

Take in hand the large brass ball electrode, attach to it the swivel of the author's insulated electrode handler, hook the opposite end of the chain to the gas fixture, and with a quick stroke throw the ball so near any selected part of the patient that a single, thick, long spark will pass. Instantly withdraw the electrode.

Repetitions of this act, following each other with greater or less rapidity, constitute a spark treatment. Operative skill and judgment regulate all that pertains to dosage in the usual manner.

The short fractional-spark application is quite the opposite of this, and is made by rapidly rubbing the ball electrode over the surface of the patient's clothing so that the current will pass through the resisting medium in a fiery trail of sharp, needle-like, minute sparks, as long only as the garments are thick.

The percussive spark may be almost any length from one to six inches, and is a single discharge. Frictional sparks are multiple, and from one-quarter to one-half of an inch only in length.

A second method of producing a similar trail of pointed darts

consists in sweeping the brass point electrode nearer the patient than in administering a static spray, and thereby throwing a shower of fine sparks as the point is swept across the surface. The brass-point electrode can be made to apply a breeze, spray, frictional sparks, or single percussive sparks, with equal effectiveness if the operator knows how.

Leyden-Jar Currents.—We now leave behind the applications of static electricity which are without parallel methods in therapeutics, and enter the field occupied by currents from induction coils, long known as faradic.

A pair of Leyden jars of one of the three sizes accompanying the machine is selected and placed in proper relation to the prime conductors. The sliding poles are brought together. A pair of the usual conducting cords is connected with the Leyden-jar attachments, and the free ends of the cords are attached to any form of electrodes employed with interrupted currents. The electrodes must be moistened if they are covered with sponge or felt. They must be placed in actual contact with the skin, and, so far as relates to disrobing the patient and manipulating the electrodes, the employment of Leyden-jar currents is the same as the employment of faradic currents. The platform is not used. There is no insulation. The current is condensed within the Leyden jar, and discharged from it to the patient, in a more of less rapid series of discharges, which are regulated by the operator. The outer coatings of the jar must not be connected by the rod which joins them for sparks.

A closed circuit of current flow is established when the electrodes are both in contact with the patient.

A slow revolution of the machine causes sparks to pass slowly, and, if the electrodes are applied to muscles, will set up slow contractions which are marked by great energy and painlessness. The poles may be sufficiently separated to obtain the

desired dose, but will exceed tolerance if too long a spark is passed. A range of one-half to two inches covers about the current strengths employed. When the plates are more rapidly revolved, the effect varies exactly as faradic currents vary with the rate of interruption.

Rapid revolutions and a rapid stream of sparks produce a high-tension current, which may be increased or diminished in strength according to the distance between the poles. A chapter might be devoted to this current alone if its various uses were described, but as it would chiefly repeat what is said of the application of all other induction currents, a full account would be superfluous. Suffice it to say that it is employed precisely as faradic-coil currents are applied, and not only may duplicate in the hands of an expert every external application customary with faradism, but goes beyond the latter in some of its effects.

The portability of the one and the cumbersomeness of the other apparatus, as well as the independence of coil currents to atmospheric influences, prevent, of course, the entire substitution of the static machine for both faradic and sinusoidal apparatus, notwithstanding that, so far as mere ability to obtain effects is concerned, the static covers about the same range as the other two.

In addition to the usual regulation of dosage when electrodes are attached to terminals upon the machine, a shunt may be employed and current strength controlled on the reverse principle of the ordinary rheostat.

Fig. 23 illustrates this current controller, which is a perfectly satisfactory instrument.

When no local application is required and a general sedative-tonic effect is sought the patient should be charged positively rather than negatively. The effects, sedative and stimulating, are relative expressions of the same constant and chief action

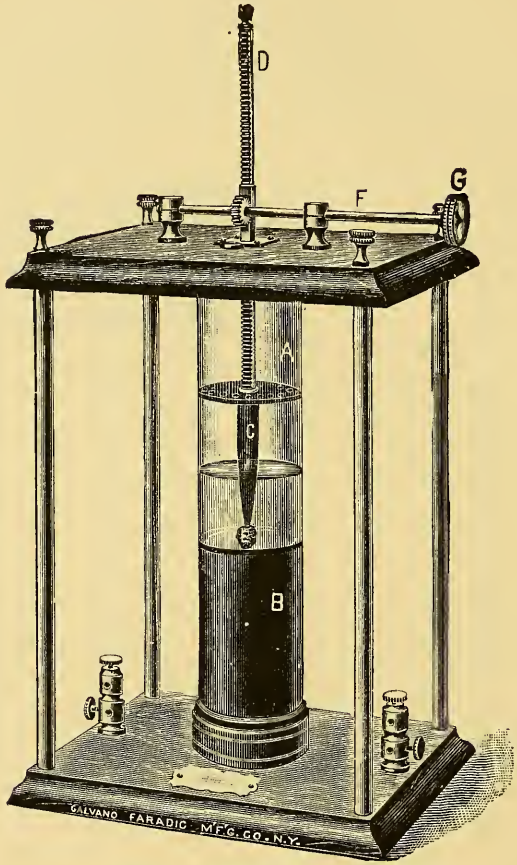


Fig. 23. Leyden-Jar current controller.

of the static charge as a function-regulator. The effect of regulating a state of circulatory or nervous excitement is called sedative, and the effect of restoring to normal a state of under-activity may be called tonic or stimulating, but both results are the effect of the one regulating tendency of the static current and cannot be produced unless the patient is in the susceptible or opposite state.

The author's method of positive potential alternation acts even more quickly and powerfully as a sedative. I prefer the

positive to the negative charge because I believe it to be more energetic in its action. I do not attribute any chemical difference to the two polarities. As long ago as 1781, and previous to that time, it was fully ascertained that: "by electrization, *whether positive or negative*, the pulse of a person is quickened, the number of pulsations being generally increased about one-sixth; and that glandular secretions and the insensible perspiration are promoted and often restored when they had been entirely obstructed."

I conclude that when a patient is seated upon the static platform and charged from the negative prime conductor the difference of potential between the charge and zero is very much less than the difference of potential between the positive charge and zero.

As the greater difference of potential represents a greater pressure force, and consequently a greater rate of change, I conclude that it is to this extent more effective in accomplishing certain results within the tissues; and as a matter of fact this judgment is corroborated by clinical experience.

Granted that the therapeutic work of both poles is in the same direction, it is evident that the polarity which produces the most active rate of current flow under the conditions of insulation, accumulation, condensation, and atmospheric diffusion will be the most active therapeutically. It is my custom, therefore, to employ the positive pole for general sedative effects in almost all cases.

Local Sedation with the Static Breeze.—To secure this effect in acute local congestions, irritable states, pruritus, dermatitis, tender and swollen joints, acute sprains and injuries, the insulation may be negative, the breeze positive, and the patient should receive the breeze directly upon the uncovered skin of the affected part.

Seat the patient on the negative platform; ground the positive pole and the brass point electrode to the gas fixture or water pipe. With the plates in moderate action keep the point

in gentle movement over and around the affected surface and beyond sparking distance if congestion or inflammation is present, for sparks should not be applied to these states.

The distance at which the electrode should be manœuvred should be such as to produce the most cooling and beneficial effect, and experience must teach this to the operator. Relief is almost instantaneous and is continuous while the breeze is passing, but to be made as permanent as possible the application should continue about double the length of time required to produce a sense of relief after the breeze is stopped.

The length of the *séance* varies in actual practice from five to ten minutes in mild cases to fifteen or even twenty minutes in more severe or very obstinate cases. This form of sedation is applicable to almost any external part of the body, and in addition to being exceedingly useful as a local sedative it produces a general tonic effect upon the entire system.

General Stimulation Effects.—The effects of static application are very much more in the nature of nutritional tonic action than of mere stimulation. I have had patients report to me that their family physician laughed at the idea of their being benefited by static electricity, and told them that it was only a "temporary stimulant like alcohol," and that "a drink of whiskey would do about as much good." The gross ignorance of facts a century old betrayed by such commonplace assertions will apparently never be educated out of the medical profession so long as medical colleges trifle with the great subject of electro-therapeutics.

If a patient is in such a state that what may be called a general stimulation of the circulatory and muscular systems is indicated, it may be obtained in any one of several ways.

A general application of a Leyden-jar current to the surface of the body will do it. Ten or fifteen minutes of simple positive electrification will do it in the mildest degree. A positive breeze to the spine with negative electrification will do it still more perceptibly.

If fusillades of sparks are thrown from the brass point to mingle with the spray application the effect will be still further increased. If the platform is again connected with the positive pole and the spinal breeze applied from a grounded brass point electrode the stimulating effect will be intensified in direct proportion to the power of the current, the proximity of the electrode, and the resistance of the wearing apparel.

If sparks are also discharged with the breeze the rate of change and consequent stimulation will be increased. If the electrode is rubbed over the surface instead of being swayed at a distance, greater or less, the stimulation will pass into a decided counter-irritant effect.

Efficient muscular stimulation is obtained by any application that will contract the muscles. The mild positive spark with negative electrification produces contractions which are proportioned to the spark length and thickness, regulated by increasing or decreasing the revolution of the plates.

With positive electrification the spark from the grounded brass ball electrode discharges the patient with a still greater difference of potential, and the increased voltage gives to the spark more pungent, stinging, penetrating, heating, and stimulating properties.

None of these effects are, however, of the nature of an alcoholic stimulation, which is evanescent and followed by depressing reaction. They are more nearly comparable with the enduring vigor imparted to the tired system by a restful and substantial meal. The great basis of value of static electricity is a nutritional, rather than a merely stimulating effect. No one need remain uninformed of the truths of electrophysiology.

Local Stimulation with the Static Breeze and Spark.—Every localized application of static electricity in any form tends to stimulate the normal function of the part. The action of remedies is to some extent regulated by the existing conditions within the patient. A hypodermic injection of a grain

of morphine would be but a gentle comforter to the victim of a cancer who is habituated to its use in such doses. It would act as a stimulant to restore the normal sense of well-being and cause no effects of narcotism.

The effect of the same administration to a person either sick or well who had never taken a dose of morphine in his life would be of a very contrary nature. To some extent, therefore, the same applications of static electricity which soothe pain, congestion, and inflammation in these overactive states are stimulating to the opposite condition; but the most direct and effective stimulation to any local part is secured by exercising the muscle functions.

What is said above in the remarks upon general stimulation sufficiently covers this ground. I shall, however, dwell for a moment upon the subject of static polarity.

Very confusing ideas are prevalent among physicians on this point; some considering that the choice of poles relates to chemical action, so that they must be as carefully differentiated as when employing the electrolytic action of the opposite galvanic poles; some holding the view that having successfully cured a case by the masterly selection of the proper pole, they would have aggravated the condition if they had employed the other; and some considering the whole matter as hopelessly tangled in confusion and ignorance and yet awaiting the conclusions of scientific inquiry.

These views may all be brushed aside. A careful reading of the chapter on electro-physiology and the actions of different administrations will show that all that need be known on these points was pretty fully ascertained when Cavallo wrote of static electricity óne hundred and twenty years ago.

It is universally stated that the positive breeze is sedative and the negative stimulating. By negative breeze is meant the application from a grounded electrode, with the negative pole grounded and the patient connected with the positive prime conductor. For the sake of simplicity, and to avoid mixing up

the teachings upon the subject, this book follows the usual statements in this regard.

As a matter of fact, however, it cannot be repeated too often or made too plain that the nature and effects of all breeze applications with either pole depend a great deal on the operator. I will now state that there is no more sedative application possible with the brass point electrode than the so-called "negative breeze," if I desire to make it so. Far from being "stimulating" and "irritating," it can be made to play like the cool zephyr of an ideal spring upon a heated and painful part, or any part wherein resides an ache or sense of irritation; and the two conditions which are all that are required to produce this most exquisite and refreshing of static sedative applications are non-resistance between the surface of the body and the point of the electrode, save only the air gap; and the reduction of the latter to about two inches—or, if the machine is in rapid motion, three or four inches.

This application, which is so delightful upon the absolutely bare skin, is also exquisitely agreeable through cotton fabrics and some of the lighter materials which ladies wear in the warm season of the year. It is the presence of thick hair upon the scalp and the resistance of woollen or winter garments which alone give rise to the prevailing idea regarding the negative breeze.

Physicians who are just beginning their experience with static electricity and who imagine that polar effects are chemical in their nature, may either read the long-established facts or inform themselves by a few simple experiments.

Polish two pieces of copper wire and attach to the tips of a pair of conducting cords. With a hard-boiled egg, a piece of raw beef, and three small dishes, one containing a ten-per-cent solution of salt, a second a ten-per-cent solution of iodide of potassium in starch, and a third plain water, determine what chemical effects really follow when the pieces of copper wire are in turn thrust into the egg, then into the beef, and then into

each of the solutions, and a continuous galvanic current of any given amperage passed for any desired length of time.

The copper wire should be polished between each experiment, and, beginning with a large current which will produce immediate chemical effects, the physician should reduce the current to discover how small a number of milliamperes is required to permit a brightly polished positive copper needle to remain in a hard-boiled egg for one hour without causing the slightest green discoloration.

Having obtained in this manner some idea of what takes place, repeat the same experiments with the static current. No further argument will be required.

Counter-Irritant Applications. — Local counter-irritation may be effectively applied with superficial and reflex effects by the static operator. It is one of the best, if not the very best, means of influencing the deeper tissues through the cuticle; and it acts almost instantaneously.

Its reflex actions are all the more pronounced because of the fact that every local application is accompanied by an impression for good upon the general system.

Local applications made with the low-potential pole connected with the platform involve a reduced voltage and are therefore less rubefacient in their effects. Those made with the pole of higher voltage effect a much more rapid rate of change and are therefore more intense and can be made more effectively counter-irritant. The principle being exactly the same whether the patient is insulated with the negative or the positive pole, I shall consider only the latter.

Seat or stand the patient upon the static platform with direct metallic connection to the positive pole. Any and all electrodes may be employed and the effect of each is modified (if it is wood) because it is a poor conductor, and increased (if it is metal) by its better-conducting properties, and by its size, shape, and method of manipulation.

The electrode selected is grounded to the gas fixture along

with the negative pole. Start the machine into action. The spine, joint, or local area to be treated should be covered with fabric of texture which will resist the current, such as coarsely woven woollen goods, mohair, silk, etc. If the patient is not so clothed it is a simple matter to throw a piece of fabric kept for this purpose over the part.

I will first refer to the use of the brass point electrode. With the machine in fairly rapid action throw upon the part a succession of showers of needle spray. If the electrode is rapidly withdrawn to some distance, and is swept up and down, or thrown toward the part only at intervals which permit intercurrent relief from the sharp sensation, the application is acceptable to the patient's tolerance.

It can be made more vigorous or milder by increasing or reducing the speed of the machine, and by concentrating or diffusing the spray. The sharp, biting discharge should not be continuously forced upon the tissues by holding the electrode still and at a short distance. Two or three minutes suffice to obtain the desired effects.

In employing the grounded brass point electrode with positive high-potential electrification the operator should personally become acquainted with the differences in sensation, stimulation, and irritation produced by throwing the point directly toward the tissues, by short strokes up and down or from side to side, by long sweeping strokes, by rapid and slower movements, and by holding the point still, at greater or less distances.

Manipulation alters the effect and there is a good deal of knack about it. The addition of volleys of sparks thrown like a fiery trail in the wake of the spray intensifies the effect.

The usual sparks with negative electrification are also counter-irritant, but in a much milder degree than sparks applied in the following manner:

Connect the platform with the positive pole, and ground the negative pole and brass ball electrode or massage roller or even

the brass point to the same gas fixture. Any electrode with a metal surface may be employed. With the machine in mild, or medium, or rapid action, according to the intensity of the heating and rubefacient effects desired, quickly advance the electrode to contact with the surface of the body and rub it over the clothing with rapid passes, maintained only for the brief time that the patient can endure the biting sensation, and then withdraw the electrode.

These hot and irritant frictions can be repeated a number of times within a couple of minutes.

The long splitting, stinging spark with the electrode connected to the negative pole while the patient is electrified positively is also powerfully counter-irritant as well as muscle-contracting.

The uses of these several means of producing counter-irritation cannot be itemized here. The practical physician will recognize when such effects will be appropriate to a given case, and it is only necessary to have in mind the technique of grading local action.

Vesication can, of course, be produced by simply pushing the application to intenser effects, but he who makes much use of static electricity soon learns to prefer milder measures and practically abandons vesication, blisters, cupping, and similar procedures which are more annoying to the patient and vastly less efficacious than the simple and beautiful resources of electro-therapeutics.

Nutritional Applications.—When the chief aim of the static administrations is to promote the general nutrition a useful starting-point is made by every form of either local or general treatment that can be applied. However, general positive electrification produces a more active rate of change within the tissues than general negative electrification, because its voltage is higher and it more readily overcomes the resistance of the insulating atmosphere and diffuses out of the patient with greater energy.

Any form of local application that is familiarly employed to improve the functions and nutrition of a part can be extended over the general surface of the body to improve the functions and nutrition of the whole system.

The static-cage application and potential alternation are excellent nutritional methods. In many cases we are content to add to general positive electrification a localized breeze upon the great nerve centres of the head and spine which influence the functions of the body.

In other cases of chronic disease with lessened sensitiveness and great tolerance of the spark I depend for the best nutritional effects upon three or four minutes spent at the close of the sitting in the application of medium sparks up and down the spine, over the great organs of the trunk and the muscle groups of the extremities, in fact to the general surface of the body below the head.

Muscle-Contracting Methods.—It requires some form of disruptive discharge or interruption of the static current to produce a muscular contraction. Leyden-jar currents with either rapid or slow interruption represent for this purpose the equivalent of induction-coil currents.

Static sparks of every degree contract muscles to which they are applied, and most powerfully so when they strike the motor point. The massage roller contracts the muscles over which it is passed. An additional method consists in having the patient hold an electrode by its hard-rubber handle and press the metallic end upon the part to be treated. With the brass ball electrode the operator applies a slow succession of sparks to any portion of the metallic surface of the electrode held by the patient. This does away with the sting of the spark directly upon the tissues, and is available in some regions whose anatomy is not adapted to sparks in the usual way, and especially if the patient is sensitive.

When a hand or arm is the part to be treated, a chain may be wound around the upper arm, or forearm, or hand, and

hooked upon either pole of the machine, serving as the platform connection. The other pole is grounded, and with the grounded brass ball electrode slow interruptions of the current are produced by sparks between the electrodes and the prime conductor to which the chain is attached. If this is the negative pole, the current will be less vigorous and the contractions milder than if it is the positive pole. The vigor of the contractions is also regulated by the speed of the machine.

If the hand is immersed in a jar of water, and connected with the prime conductor of the machine by dropping the tip of an ordinary cord into the water, the sparks upon either the sliding pole of the machine or any part of the patient's body will exercise the arm from the finger-tips to the shoulder.

Massage, Electrical and Hand.—In some degree every form of electrical application with an interrupted current which produces a muscular contraction is massage. The muscular contraction of the static spark constitutes a very powerful form of massage.

The application of the roller electrode is so similar in principle to massage that it has long been called the massage roller. The application of Leyden-jar currents to the surface of the body as in general faradization constitutes a very thorough and efficient form of massage.

Rapidly interrupted high-potential currents produce a vibratory action within the tissues for which there is no counterpart in manual massage, and the author's method of potential alternation involves a fine bombardment of the nervous system of a kind and degree which the hand of the masseur is inadequate to produce.

The effects of massage are local and systemic. The physiological effects are succinctly stated by Bartholow: "The masseur puts forth more or less muscular power, which at the points of friction develop another mode of motion—heat. The action thus induced in the tissues elevates the temperature; the vessels dilate and an increased quantity of blood enters them,

and the motion of the blood current is accelerated. The immediate effects of these changes is to promote the nutritive energy of the tissues subjected to friction. This result is seen in the improved color, warmth, and volume of the parts. A general rise of temperature averaging about one degree takes place quite uniformly. The body increases in weight; all the organic functions are performed with more energy, and power is gained in every way.

"Massage in its several forms exercises peculiar effects on the nervous system. When an inflamed part, such as a joint which can be manipulated, is rubbed with excessive gentleness, the sensibility, which was at first so acute that every touch gave pain, readily subsides, until, after an hour of friction, it may be handled with some roughness without evoking painful sensation. The state of spasm of a muscle is relieved and relaxation induced by persevering rubbing of the affected muscle.

"Therapeutically massage is employed in wakefulness and nocturnal restlessness, simple headache, neuralgia, hemicrania, migraine, spinal pain, paralysis, progressive muscular atrophy, chronic joint affections, synovitis, contractions and deformities, thickening from inflammatory deposits, neurasthenia, anæmia, hysteria, constipation, rheumatism, etc."

While speaking of the extraordinary utility of massage in certain cases Bartholow also states that "patient and long-continued use of the method may often be required."

The confidence of the medical profession in massage is very great. It is in good repute among the laity. Its merits are usually set forth by those who pursue the vocation of rubbing people in about the following manner:

Massage is a scientific mode of systematic manipulations upon the nude skin of the human body in a passive condition. It includes percussion, friction, kneading of the muscles, exercising the joints. The physiological effects of massage include the incitement of the nerve centres, a healthy rise of temperature, acceleration of the blood current to the arterioles, promotion of constructive metamorphosis and the nutrition of tissues; also destructive metamorphosis,

excretion of waste substances and a general increase of muscular force.

Its effects upon the nervous system are soothing; and by skilful, gentle manipulation the acutest pains gradually depart. Under the treatment of a scientific operator morbid mental states give place to hope and cheerfulness and all the functions of the body are performed with increased energy, causing those benefited by massage to say: "*Life is worth living.*" The most eminent physicians in Europe and in America give massage a prominent place among topical health-restoring agents and highly recommend it as a valuable therapeutic auxiliary. Therapeutically massage is beneficial in the treatment of . . . and similar diseases.

Sufferers from obesity have been greatly benefited and their weight reduced by massage. For weak and sickly children also suffering from infantile paralysis massage is the best topical remedial agent. Persons who are free from organic or symptomatic disease, but are deprived of outdoor exercise, including clergymen, lawyers, and all whose brains are overtaxed will find the soothing manipulations of a skilful operator a mental and physical luxury.

No one who will study the physiological action and witness the therapeutic effects of galvanic, faradic, and static currents of electricity, in the great variety of local and general methods by which they may be administered, with their wide range of exact dose regulation, will fail to see that every demonstrated influence of massage upon the human tissues is included within the compass of electro-therapeutics; and the skilled operator with fine apparatus can so far surpass the manipulations of the hand that all that can be claimed for massage simply demonstrates the superiority of electric current action.

Referring especially to the ordinary applications of static electricity for exactly the same long list of diseased conditions for which massage is recommended, it may be said of massage that it is not usually performed by the physician, but involves putting the patient into the hands of a third party, who is often destitute of medical education, but who fills the ear of the patient with attractive stories and takes all of his money that he can get. On the part of the patient it involves disrobing, and the sacrifice of about an hour's time for each *séance*, and the

development of effects by a slow and tedious process. In the case of pain and acute inflammation of a joint a good operator will succeed slowly at best, while a poor operator can easily make matters worse.

The applications of static electricity are made by the physician himself. He keeps his patient in his own charge without outside interference. The patient is not required to disrobe, and the treatment occupies only from five to fifteen minutes.

Symptomatic relief, especially relief from pain, is obtained in a manner as much superior to the processes of massage as the electric light is ahead of the old wax candle.

Massage cannot by any possibility do any good to the patient that static electricity cannot equal or surpass.

Static electricity can do much for many patients that no *masseur* has ever dreamed of accomplishing. However, it is equally true of both massage and the static machine, that each requires an experienced and competent operator; and if the patient is confined to his room and is neither able to visit the physician's office nor enter a well-equipped sanitarium, the *masseur* can reach him and do him good while the static machine cannot.*

* Much of the best electro-therapeutic work in medical practice depends upon non-portable apparatus for its accomplishment. Physicians and surgeons who are completely equipped with improved static, galvanic, and high-tension induction-coil apparatus will do much to extend their usefulness by receiving patients into their residence if they are not in sanitarium work. In this way many cases may obtain the benefits of frequent and thorough treatment who would otherwise be deprived of relief. This has been the author's practice for a number of years and possesses advantages in favor of both the medical attendant and the invalid. I am certain that in some of my cases more benefit has been given them in a month by having them in my house than they could have obtained in six months by attempts at even similar treatment if daily journeys to and from the office had been undertaken.

CHAPTER XIII.

INDICATIONS AND CONTRA-INDICATIONS.

Indications for electric currents. Principles governing therapeutic indications. The polar theory of disease. Indications for static electricity. Contra-indications of galvanic, faradic, and static currents. Aggravations by static electricity. Precautions after treatment. Relation of common condition to success or failure in general electro-therapeutics. Disrobing for general electrical applications.

Indications for Electric Currents.—One of the most perplexing questions to the practitioner in his first attempts to employ electric currents relates to the differential indications for each, and the choice of methods in particular. The road out of this difficulty is exactly the same as that over which every educated physician has passed in acquiring knowledge of *drug indications and doses.*

Every man who prescribes accurately must study his *materia medica*, and the same study of medical electricity will quickly settle most of the practical difficulties which confront the beginner. There are indeed theoretical difficulties which are discussed at length by theoretical writers, but these give little concern to the clinician.

Compared with average prescribing, and especially with prescribing according to *symptoms*, electricity can often be more accurately and successfully prescribed than almost any of the drug agents of the *materia medica.* In many cases of disease it is impossible to prescribe any drug until a correct diagnosis is made, and over the diagnosis a number of consultants may dispute. As a matter of fact many diseased conditions are mixed types.

Whenever any form of electric current is indicated by gen-

eral or local conditions it comes nearer to an exact therapeutic weapon in the hands of the expert than any approximately equal resource in medicine or surgery. There is less guess-work in skilled electro-therapeutics than in drug-prescribing or pelvic surgery.

The same careful study that all physicians are compelled to give to the action of iodine, mercury, opium, belladonna, digitalis, and all active remedies is necessary to an equal understanding of the action of galvanic, high tension induction coil, and static currents. *Nothing else* is needed except the *study* of accurately demonstrated facts, and there is no other way to obtain the requisite knowledge.

The indications for the uses of each current are mainly found in the record of the demonstrated physiological and therapeutic actions of each current. I have condensed these into three chapters in this book in the plainest manner possible to present the facts, and if the reader will familiarize these chapters the question of *indications* will be practically freed from perplexity. Clinical experience will do the rest.

In numerous writings, especially in text-books relating to general therapeutics and medicine, the physician is confused and distracted by vague and unmeaning references to methods of electrical treatment, which aim over the head of the general practitioner and strike at no definite mark. Some of these terms, which mean very little to the physician who seeks clinical directions for the treatment of a given case, are galvanization of the sympathetic, voltaic alternatives, spinal galvanization, galvano-faradization of the brain, sub-aural galvanization, indirect faradization, direct faradization, direct and indirect electrization, plexus nerve current, spinal cord root current, electric aura, electric souffle, and a score of others which need not be repeated here. None of these terms are employed in this book, it being the purpose of the writer to state plainly the essential details of treatment in terms which can be understood by every physician who reads them.

Moreover, the object of employing electric currents in the

treatment of disease is to produce known and desired therapeutic effects. I do not regard electro-therapy as a jargon of cant technical terms, indefinite *galvanizings* and *faradizings* of centres, nerves, muscles, organs, and what not, according to a dozen whimsical and other irrational theories. I regard electrical prescribing from the same standpoint as drug prescribing.

The perfunctory view of static administrations denoted by vague references to electrization, aura, souffle, breeze and sparks is aimless and fruitless of medical action, while, on the contrary, a definite technique for the production of *positive and predetermined effects* (sedative, tonic, nutritional, stimulating, muscle-contracting, counter-irritant) means something intelligible to the physician. These effects, when they are procured, either generally or with relation to special parts, are rational therapeutic actions, and can be directed to the treatment of disease in accordance with the established principles of medicine.

Galvanic and faradic currents from improved and scientific apparatus must be regarded in the same way. They will produce a variety of *effects* upon and within the human tissues. These effects can be produced at will—any one or more of them—by modifications of the dose and management of the treatment. Clinical experience and physiological experiment have demonstrated forty or more of these important special actions of the different varieties of current dosage, and these are set forth in the chapters upon electro-physiology in this book.

He who familiarizes himself with the possible effects of the different electric currents, and learns how to regulate each form of current to produce at will each form of effect, has at command the practical resources of electro-therapeutics in the most intelligible and serviceable manner.

To accomplish this end, the beginning consists in knowing how to move the switches, screws, and mechanical parts of the galvanic and faradic switchboards to produce at will any desired dose, to acquire by a few hours' practice the knack of

managing the static machine, and afterwards to memorize the well-known demonstrated therapeutic effects which dose regulation of the three great currents will produce.

The simplicity of proceeding thus far makes ridiculous a great deal that has been written in the past about the difficulties of becoming skilled in this branch of practical medicine. The physician has already his general medical education to furnish the substantial groundwork, and as soon as he knows enough about a battery to adjust the dose, and about *effects* to produce them, he is prepared to develop satisfactory clinical experience. This is a practical and correct view of electro-therapeutics and indications.

In looking through about a dozen of the electro-therapeutic publications of the last fifteen years, including standard treatises by both foreign and American writers, I have been astonished at the immense number of *impracticable* methods which have been given currency by supposed "authorities." Some of these methods are described in such a manner that no one can tell how to repeat the application; some of them are so eccentric and crude that they must of necessity have failed to serve their intended purpose even in the hands of the original "authority."

Others (particularly needless forms of galvanic and faradic puncture) are ingenious forms of torture. Some go to the extreme of making one current serve purposes for which other currents are better suited, and many methods are so vaguely stated that they pad out large books but instruct no readers.

Some authors "faradize" almost every patient, some "galvanize," and some "cauterize," and exhibit much ingenuity in referring to impracticable methods which smack of the desk and can hardly be put to clinical uses. Enthusiastic advocates of local methods which require the application of moist electrodes to very inaccessible portions of the body make the mistake of assuming that the results which they obtain with so much difficulty (both to themselves and the patient whom they require to disrobe) could not be just as well obtained

with half the trouble by familiar and superior methods with currents which require no disrobing.

If these "dead-wood" directions could be purged out of existing electro-therapeutic literature the subject would be extraordinarily simplified and the practical gain to physicians would be very great.

Another remarkable feature about electro-medical writings is the prevailing habit of calmly asserting an ignorance of the entire profession about matters of long demonstrated knowledge of which the speaker or author himself happens to be ignorant. Readers who accept at their face value the hundreds of such assertions of ignorance that have been made during the past ten years must lose heart before attempting to acquire any satisfactory information concerning practical electro-therapeutics.

I have now before me a single column just published by a physician who is perhaps the best known electro-therapeutist in his own State, which contains three of these common errors of assuming the non-existence of facts which have been demonstrated over and over again for several years.

It is almost impossible to take up any book or extensive Journal article dealing with the subject of medical electricity in which the author does not disclose some more or less glaring ignorance of either improved apparatus or the physiological action of some one or more of the different currents.

Exempt from this statement is the small group of careful and methodical men who write close to the line of their own practical experience, and who have been in the van of progressive development of this branch of medicine.

It certainly requires a greater amount of knowledge to steer clear of the mistakes and unreliable directions recorded in great numbers in outstanding literature than to apply successfully in ordinary practice the few principles of technique which cover the useful range of electro-therapeutics.

There are many things which can be accomplished by the action of electrical currents which it is not worth while to

accomplish by their aid, for by other means in medicine and surgery we can secure as good or better results more easily. In other cases electricity is simply on a par with other measures and the practitioner will prefer the means with which he is best acquainted. The practical scope of electro-therapeutics, therefore, lies far within the *extremes* of current action and is limited to the treatment of cases in which electrical currents possess clinical superiority. This fact alone brushes aside at once nearly half of the troublesome methods of technique described by voluminous writers who exhaust one remedy at the expense of better. To appreciate how much a judicious sorting of clinical methods is needed by the practical physician one has but to read any of the electrical text books of a few years ago, and especially the European works which go to extremes with galvanic and faradic currents.

Some thirty years ago the choice of polarity was for a time reduced to a very simple basis by a group of men who lectured about the country and treated patients as they went. About a dozen of them published small books which described some of the commonplaces of curative results as among the magical wonders of electricity and at the same time illustrated the most inferior forms of faradic batteries from which some of them obtained both galvanic and coil currents, or, as they expressed it, " pure electricity " and " magnetism."

They simplified all diseases into *electro-positive* and *electro-negative* and applied the positive pole locally to all processes which were under-active and the negative pole to all processes which were over-active. About a year ago I published a careful synopsis of these theories taken from a work published in 1869. Writers of the same class also employed " unequal cords " and aimed to subject the tissues entirely to the action of a single pole by connecting it to the battery with two yards of copper wire while the opposite pole was connected with one yard.

These theories crop out anew in our own time, and but recently I have seen the long and short cord idea published in

a Medical Journal as if it was something not only valuable but new. None of these antiquated theories could apply to either induction coil currents, the interrupted galvanic current, or static electricity, and much of the mysticism imparted to medical electricity by visionary lecturers from 1840 to 1875 has disappeared under the development of industrial electricity since 1885 and the discovery of exact scientific laws which control the action of all electrical currents. The management of electrical machinery in any form is now as practical as the management of other machinery, and clinical experience has established a rational and practical electro-therapy which is much less complicated than that of yore.

The theoretical range of therapeutic indications for static electricity is nearly as wide as disease itself, for at some time in almost every important deviation from health it can be employed with benefit to the patient, if the physician and patient so desire. It may be usefully prophylactic before lessened tissue resistance furnishes the nidus for definite disease; it may in some form palliate, and in other cases cure, a great many states of sickness which are not toxic or febrile; and when no active part befalls it in acute stages it will do much to shorten a tedious convalescence.

In the surgical office it will light up a Crookes tube more radiantly than any other present means of electrical excitation and with the flouroscope or photographic plate make the examination of fractures, dislocations, and a variety of bone lesions more satisfactorily and instantaneously than any other means.

It will often relieve the nerve and muscular effects of traumatism, allay local inflammations, subdue pain, restore the circulation to contused parts, quicken the reparative processes of nature, increase mobility of stiffened muscles and joints, provide a superb form of passive motion and massage, excite recuperating contractions in muscles paralyzed from injury or the inaction of splints, tone up and strengthen the patient, and, in expert hands, will render with quick facility, and, with far less

trouble than any other equally efficient procedure an immense amount of invaluable aid.

It is the most extensively useful single instrument now employed in medical office practice for the relief of non-operative and non-septic conditions, and is absolutely without a therapeutic rival in the complex and useful nature of its achievements.

It may be granted at the outset that certain conditions of disease and certain pathological states will never, or very rarely, enter into the consideration of static electro-therapeutics, so long as its employment is inseparable from the physician's office. Acute infectious fevers and contagious diseases are examples. Such affections as are in an acute stage are rendered worse by exposure to outdoor air are of course other examples, and also cases in which neither of these conditions operate, but which are accompanied by symptoms which render recumbency and rest essential.

Thus by a simple elimination of classes of cases, such as will occur to the mind of every experienced practitioner, including conditions in which the result of time-tried remedies leaves little or nothing further to be desired, we define the limitations which practically determine the uses of static electricity.

We, therefore, find its chief field of usefulness in the treatment of conditions, either acute or chronic, which have to do with nerve action, circulation, muscles and joints, pain, functional processes and nutrition.

From the standpoint of pathology its tissue action is very narrow, but so is that of iron; but both iron and static electricity become of immense practical usefulness from the commonplace fact that a great many people present the conditions which they favorably affect. Phosphorus cuts a much wider swath through the human tissues in its physiological action than does iron, but fifty patients need ferrum where one needs phosphorus.

Yet, operating within the boundary of its proper restricting limitations, it will be observed that the same static machine

will accomplish much more in some hands than in others. There are in every department of mechanics certain workmen who have the knack of getting exceptional work out of ordinary tools. I have seen watchmakers with an elaborate outfit of costly implements whose skill in using them was much less than their cost, and I have seen others with but a few plain tools who would handle successfully any job on the workbench.

This difference in the native knack of men will always influence both the variety of work done by the static machine and the satisfaction with which it is utilized in individual practice, for it cannot be too strongly impressed upon the mind that it is the presiding genius and personal ability of the operator, and not the intrinsic resources of the machine, however great, on which rests the successful application of static electricity. This is the explanation of many of the failures and disappointments recorded against the static machine of some years ago, and it is equally in force to-day.

Contra-indications.—The thoughtful consideration of every physician is invited to this phase of the subject of medical electricity. When the indications for selected methods of electrical treatment are properly understood, and an intelligent idea of contra-indications is obtained, a great step is taken toward rational therapeutics.

It is one of the misfortunes attending the lack of undergraduate instruction in electro-physiology that many patients to whom the resources of medical electricity would be an inestimable boon are deprived of its beneficent action through erroneous medical advice. There is certainly no other branch of therapeutics which suffers so much injustice through lack of information concerning its actual merits.

This being the case, it is a matter of great regret that the entire medical profession is not so well informed upon the physiological action of all electric currents as upon the actions of leading drugs.

Galvanic.—The contra-indications of galvanic currents in gynecological work are completely set forth in the chapter upon

electro-diagnosis. It will be observed that these contra-indications follow certain principles which may equally be applied to the surface of the body or any other tissues outside the pelvis. It is a waste of time to employ the galvanic current when it will not do as well as induction or static currents, and while the discriminating use of each current is not based upon actual contra-indications from the standpoint of possible harm, yet the study of the chapters upon electro-physiology and therapeutic action will give valuable help in enabling the physician to select the right current at the right time.

Whenever a galvanic current is employed it can be so modified as to be free from injurious actions by following the rules given in this book.

Faradic.—Induction coil currents from improved apparatus are quite a different matter from the popularly known faradic current in general use. The question of contra-indication is therefore entirely different and the teachings of the past are now subject to many exceptions, particularly as regards the uses of coil currents in inflammations. Hardly any old work upon electricity can be opened without finding warning against the use of the faradic current in many conditions in which improved induction coil currents are now one of the best remedies. Readers are many times warned that the faradic current is painful in cases in which we now employ it to soothe pain and allay nervous irritability. As, however, the induction coil and Leyden-jar currents possess similar therapeutic actions, I will consider them both under the head of Leyden-jar currents in my remarks upon the contra-indications for static electricity. This will save unnecessary repetition.

Static.—While the indications for different forms of static electricity cover the general range of usefulness set forth in the chapter on physiology, yet the contra-indications are seldom concisely stated. They are as follows:

General Electrification.—A careful study of the action of general electrification upon the pulse, temperature, respiration, and secretions demonstrates that there is no state of the tis-

sues in which it would be essentially injurious—there being no state of disease in which a regulation of the functions to normal is contra-indicated.

Clinical experience demonstrates that general electrification acts without harm, and with benefit, in all diseased conditions amenable to curative treatment, whether they are acute or chronic, febrile or the reverse.

General electrification will not benefit perceptibly a person who is already in sound health, and patients who exhibit any of the conditions which prevent office visits do not present themselves for static treatment; hence these are *negative contra-indications.*

Positive contra-indications to general static electrification can hardly be said to exist, for it produces no injurious effects upon the human system. It is as harmless in acute inflammations as in chronic diseases, although medication supersedes it for various reasons.

The Static Breeze.—Contra-indications can hardly be said to exist for purely sedative forms of the static breeze. These can have no possible injurious effects, and the only contra-indications can refer to the fact that when other measures are needed it would be a waste of time to employ an application which was not the most effective that could be used.

Passing from the sedative to stimulating, rubefacient, and counter-irritant forms of the breeze, it suffices to say that both indications and contra-indications conform to the general principles of medicine, and do not differ because the agent which produces these effects is an electric current instead of a drug formula.

The Static Spark.—The great contra-indication for powerful static sparks is the same which forbids mechanical violence of any other kind. There are, however, modifications of the static spark, so that contra-indications undergo equal modification; and in many cases of disease, when the pressure of the hand cannot be borne without pain, a mild static spark will allay the pain, restore local nutrition, and bring about sympto-

matic relief in many cases, and an entire cure in some cases. This is a common clinical experience.

Leyden-Jar Currents.—If it be granted that the operator conforms the application and dosage to the therapeutic requirements of the case, it can be also be said that positive contra-indications do not exist. A strong current is of course contra-indicated when a weak one is required, a slowly interrupted current is contra-indicated when the physiological effects of a rapidly interrupted current are sought, an application with labile electrodes may serve in one case while another case would require that the electrodes were stationary—and so on through all the gradations of electro-therapeutic administrations, we may balance one method against another, and finally find that there is scarcely a patient who could not be treated in some way by some form of static electricity without harm and with more or less benefit.

The harmlessness of this agent when applied with due regard to indications cannot be too fully understood by the medical profession, however some may regard the demonstrated clinical results. It is reassuring to feel that there is no risk whatever in treating a patient whom we may not feel certain of doing decided good, but whom we should be very reluctant to harm in the slightest degree.

For many years statements regarding the danger of other electric currents have crept into medical literature and serve to influence the majority of the profession to apply the same reasoning to static electricity.

Many of the authors who wrote in former days would now employ improved apparatus and would revise their statements if they were living.

In a popular work on the subject of electro-therapeutics published in 1888 the author of it refers to the indications for "galvanism" in a certain disease and speaks of "faradism" in the following manner:

Whenever the mistake has been made of using faradism

in——, serious loss and injury have been suffered. The prime need is for a sedative, and directly opposite in effect is the induced current, which but adds fuel to the fierce flame of disease. It should never be employed in this disease, not even as an application to parts distant from centres.

The lamented author of the work in which this now obsolete paragraph appears was on a point of revising it when he died. *The sedative effects of improved high-tension induction coils represent one of the distinct advances in electro-therapeutic apparatus since 1888.*

I have now a report from a physician who has successfully treated a case of the same disease referred to above with the modern sedative induction-coil current. It ought to be generally recognized that the contra-indications which definitely apply to a particular battery, or current, or dose, or method, or to maximum administrations, may not apply to different currents, different apparatus, and intelligent modifications in scientific electro-therapeutic treatment.

Aggravations by Static Electricity.—Once in a while some writer reports that static electricity aggravates the disease. He means, rather, some form or dosage of static electricity, and generally the spark—which is contra-indicated in conditions in which mechanical violence is contra-indicated, but which is not seldom ignorantly employed, both when it should not be used and in ways that it should never be used ; for the spark can easily degenerate from a valuable therapeutic measure into mere brute force.

Moreover, the spark is by no means the whole of static electricity. I once knew an old lady who was fond of stating that " she did not like fish." She also claimed to " like meat." On careful inquiry in regard to particular kinds of these foods I found that she admitted the ability to eat with relish six individual kinds of fish, and really liked only three different kinds of meat. When the spark is not acceptable with relish (therapeutic benefit) almost the whole field of static electricity is

still left from which to choose a form of application to suit the case.

In one of the opening chapters of this book I have shown that a prominent electro-therapeutist of national reputation and since deceased, stated in 1892 that he "had abandoned the static spark as a pain-killer, believing that in a majority of cases, no matter how skilfully handled, it is as apt to aggravate as to relieve."

Such statements mislead the uninformed physician. It is impossible to regard them in any other light than as a declaration on the part of every such writer that he has not carefully studied electro-physiology and the action of the percussive spark, and has not been guided by indications, but has applied the spark without regard to indications. Mere skill in the manipulation of an electrode does not offset the injurious effect of setting up a violent perturbation in tissues that are moaning for soothing rest.

Practically speaking I never aggravate a patient with static sparks. It is needless. I never fail to advance with caution in the treatment of every state of doubtful pathology, and every strong spark that I administer has had predecessors to make a reconnaissance with milder force. At the first sign of a contra-indication I stop the spark, but I know so well in advance when sparks will do good and when they will not that my experience with even momentary aggravations has become exceedingly limited.

However, when a pathological state protests against a tentative spark, a brief application of the sedative breeze immediately removes the first and last vestige of irritation, and there ends the aggravation. I cannot conceive the possibility of my persistently hammering away with strong sparks at sitting after sitting upon tissues that were indicating by every possible means they could express, the use of some other method.

The therapeutic principles are too simple and clear to justify any such procedure. If the operator errs through ignorance at the outset of his experience, as he sometimes errs in the

dosage of drugs, he should strive to learn better by studying the subject.

Precautions after Treatment.—Some physicians keep their office very warm and some patients wear very warm clothes. When these conditions are combined with an energetic application of static electricity a sensible perspiration is set up and should be allowed to subside before the patient goes out into an atmosphere which is liable to cause her to take cold. Aggravations sometimes occur from this cause and especially when the patient steps from the office to a street-car and is subjected to draughts. Ten minutes of rest in the reception-room is a wise precaution in every case in which perspiration has been induced.

Relation of Common Conditions to Success or Failure in General Electro-Therapeutics.—There are three prevalent conditions which occupy an important relation to electro-therapeutics and call for special remark. These are anæmia, chronic gastric ill health, and a state popularly known as bilious or malarious.

Electricity holds a subordinate place in their ordinary treatment. In most cases of anæmia the action of iron, arsenic, and other chief drugs, administered three times a day, is much more rapid and satisfactory than static electricity alone when it is administered but three times a week. Electric currents do not take the place of hæmatic remedies, nor of proper medication for gastric and hepatic derangements, though electricity is certainly not without beneficial action in assisting the functions of the digestive organs. Dependence upon it alone is, however, a cause of disappointment in many cases, and the secret of failure to repeat the results of successful operators is often to be found in a torpid liver or neglected gastro-intestinal complication.

It should, therefore, be the first duty of the physician who is about to employ static electricity by general methods for its tonic or nutritional effects to combine suitable and necessary medication to put the patient in a state to receive the full

benefit of the influence for good that is exerted by electrization upon the nervous system, which in turn will then proceed to improve the whole body.

Disrobing for General Electrical Applications.—A careful study of the causes which operate to render general electrical applications distasteful to patients, and repugnant to physicians in ordinary office practice, places disrobing in the front rank and leads me to emphasize here an advantage possessed by static electricity which is of surpassing and even incalculable importance in practical electro-therapeutics: *it requires no removal of clothing.*

Minor or limited local applications of galvanic and faradic currents may readily be accommodated to the necessity of surface-contact electrodes, for exposure of the person can either be avoided or restricted in extent. But both physician and patient may well stand aghast at the mere thought of general administrations of any form of electricity which involve both the drawbacks of disrobing in an office, and the application of the hand or moist electrodes to the entire person. These drawbacks, relating both to the disrobing and to the treatment, cannot be appreciated at their full weight without experience with cases suffering from pain, deformities, paralytic affections; or fashionably attired women, or persons whose failing faculties, crippled conditions of limbs, or sensitiveness to the appearance of undergarments make it difficult, embarrassing, or practically impossible for them to undress and dress themselves again in an office.

To the therapeutist who recognizes the usefulness of general electrization in a large proportion of all cases in which electricity is indicated at all, it is simply despair to contemplate galvanic and faradic methods for constitutional, tonic, and nutritional effects.

The usual alternative in practice is to disregard them and wholly ignore the benefits they would produce. This alternative does not confront the possessor of a Holtz machine, and the facility with which an expert can by its aid employ the

resources of general electrization without any of the loss of time and inconvenience of disrobing, puts the stamp of practical superiority upon a form of current whose properties are peculiarly adapted to general administrations for sedative, tonic, alterative, restorative, and nutritional effects.

A considerable clinical experience convinces me that I can treat ninety per cent of cases amenable to benefits from any form of general electrization more successfully, quickly, and with more permanent satisfaction by the aid of the static machine than by currents requiring the application of electrodes to the body.

Granted an equal therapeutic value, the current which may be applied through the entire clothing possesses an advantage over all others. It is this advantage which belongs to the static machine and which places it prominently among the necessities of a complete electro-therapeutic equipment for general medical and surgical practice. The indispensability of both galvanic and faradic apparatus has long ceased to be open to question, and when the technique of the third great therapeutic instrument is once mastered, it will be found equally indispensable.

CHAPTER XIV.

ELECTRO-DIAGNOSIS FOR THE GENERAL PRACTITIONER.

Scope of electro-diagnosis in practice. Motor points. How to locate motor points without a chart. Galvanic and faradic reactions in pelvic diseases. Their diagnostic value.

A FEW words on this subject will clear away some of the confusion that pertains to it. There is no known method of "diagnosing diseases by electricity," as the average physician understands the word diagnosis. Many of the conclusions of experimenters in the study of electro-diagnosis are erroneous or of no practical value. In the *treatment* of patients a number of things may appear which confirm or alter previous diagnosis, or affect views of the prognosis of the case, and occasionally some test of the electrical reaction of a part may be made in advance of treatment, but the complete examinations of nerve and muscle reactions set down as necessary in chapters upon electro-diagnosis do not enter into practical medicine.

The diagnosis of the general practitioner may be made by the usual clinical methods and treatment instituted accordingly. During electrical treatment we may find an unsuspected area of great sensitiveness, or great dulness of sensation, or we may find that muscles contract less quickly than in health, or that the results of the method we have selected do not prove satisfactory. In all these cases we must look for the cause and diagnose the condition by the familiar methods of practice.

The electrical irritability of nerves and muscles may differ in two ways; in quantity or quality. I know of nothing in the literature of medical electricity so lacking in practical value and so totally useless to the physician as the laborious efforts that have been made to develop electro-diagnosis. Much

attention has been given to the subject by ingenious and devoted men, but their work has availed little. As a curative agent, as a palliative of symptoms in incurable cases, as a means of deciding from the results of treatment between two suspected but undetermined conditions, and as a help in arriving at an early prognosis, medical electricity possesses a value which easily places it in the front rank of extra-drug remedies, but there is no system of electro-diagnosis of general diseases, such as make up the routine of office practice. As a matter of fact I would about as soon think of questioning the patient in the Sanscrit language to obtain a history, as to put him through the technique of interrogation with a pair of electrodes in the manner recommended in some writings upon electro-diagnosis.

Diagnostic and therapeutic hints of great value may develop during the treatment of complicated cases, as we discover abnormal sensations and unusual effects and carefully investigate their cause by inquiry and by other methods of physical diagnosis. This, however, seems to me something quite apart from the idea of electro-diagnosis presented to the physician's mind by his readings of electrical reactions, quantitative and qualitative changes, increased or diminished excitability, the reaction of degeneration, and such symbols as the following:

$$\text{Ca. Cl. C., An. O. C., An. Cl. C., } D=\frac{x \text{ m m. C. D.}}{10^2 \text{ cm.}}$$

Ka S Kl, Ka D Kl 7, Ka O–, An O Kl, etc.

It is, however, the only practical part of electro-diagnosis in clinical experience.

An author of a work upon electro-therapeutics begins his chapter on electro-diagnosis by stating: "When a patient with "any disorder of the nervous system presents himself for "electrical treatment it is nearly always necessary to begin "with an investigation of the electrical reactions of his nerves "and muscles. The motor nerves and the skeletal muscles "should be investigated first and both the faradic and the con-

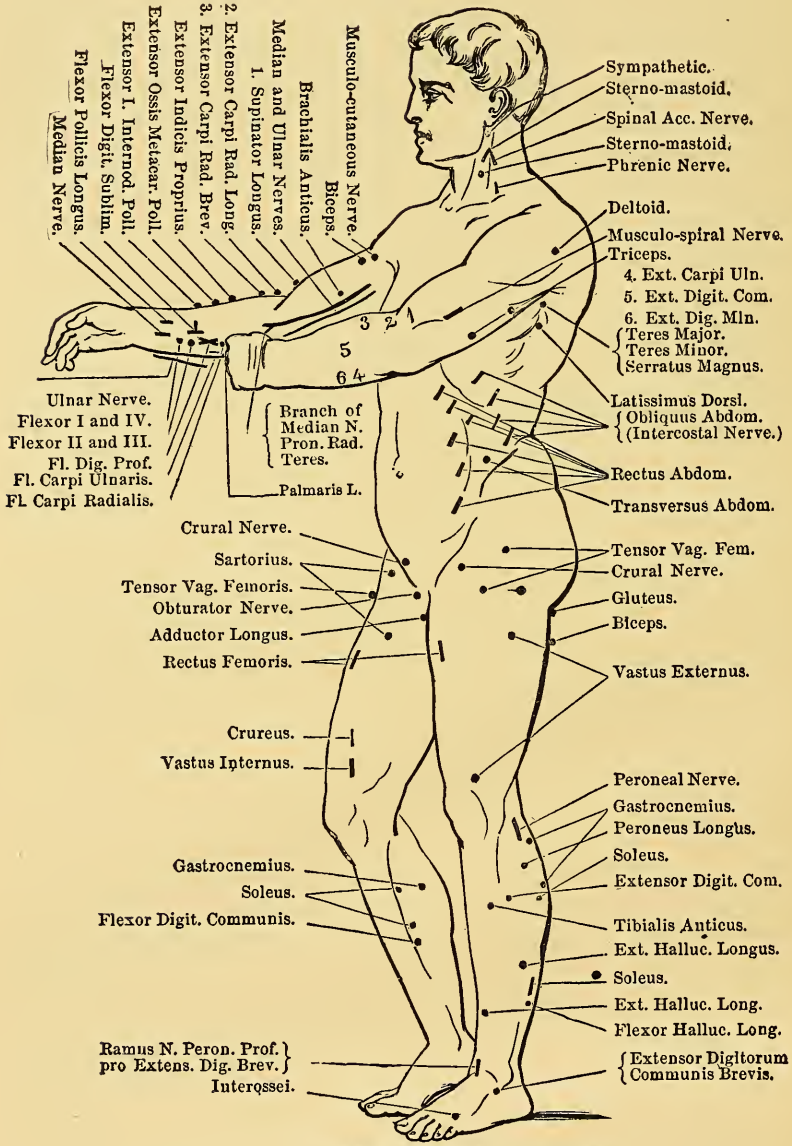
" tinuous currents must be employed. The unipolar method " must be adopted and the tests must be applied to the motor " nerves, the muscles and the cutaneous sensory nerves in the " parts affected, and they must be compared with the same " parts of the sound and healthy side. To do this it is abso- " lutely essential to know thoroughly the points where the " nerve trunks are most accessible, the motor points of the " muscles, and the distribution of the cutaneous nerves."

Such a method of examining patients seems to me difficult to consider in office practice, and the most careful researches which I have been able to make into the disclosures which would result from such examinations do not reveal recompenses for the time and trouble. The procedure is inaccurate, does not determine the nature or cause of the disease in important cases when such information is desired, and belongs to the realm of theoretical and experimental work rather than of practical therapeutics.

An increased or diminished sensibility to a given electric current will often indicate a departure from the normal in the state of the tissues through which the current passes, but it very seldom discloses the diagnosis of the lesion. The nearest approach to exactness in electro-diagnosis is the test to determine between a central and peripheral paralysis, but even to this rule there are exceptions, and the discovery of the reaction of degeneration does not make clear the exact cause behind it. This is upon the surface of the body. Within the pelvic cavity there are some important diagnostic suggestions derived from the behavior of the tissues under electric currents to which I shall presently refer. See chapter on paralysis for muscle tests between central and peripheral lesions.

Motor Points.—How to locate motor points without a chart is one of the perplexities of students of medical electricity which cease to trouble after a little practice.

Place any ordinary sponge-covered flat electrode upon a folded towel on the knee of the patient and let him rest upon it the flexor surface of the forearm, a couple of inches above



MOTOR POINTS OF TRUNK AND LIMBS.

Fig. 24.

the wrist. Connect this electrode with the positive pole of a high tension induction coil apparatus.

Take any ordinary sponge-covered hand electrode, moisten it with warm water, and rub it a few times over a cake of soap. Connect it with the negative pole, and pass it up and down, and over every portion of the arm of the patient, from the shoulders to the finger-tips. The proper current strength must first be found. Switch the 800 yard No 32 coil, rapid vibrator, and three cells, into circuit. After contact is made with both electrodes, increase the current in the secondary circuit from zero until it produces some visible contraction

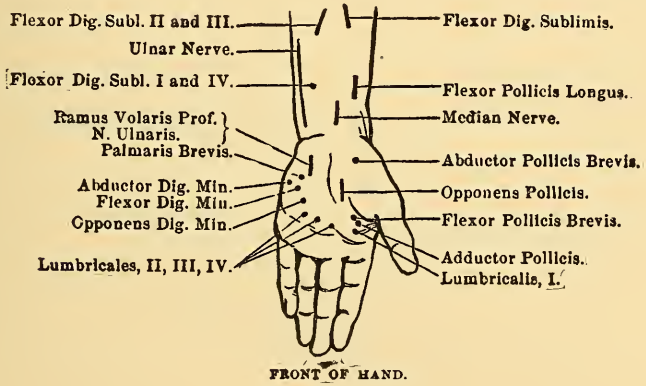


Fig. 25.

of muscles as the negative electrode is moved about over the arm.

As the labile electrode is promenaded over the surface of any part of the arm, or forearm, the presence of each motor point will be exactly demonstrated by a contraction of the muscles supplied. If the electrode is swept back and forth, the contractions will follow each other in a series of waves. If the electrode is steadily held upon the motor point, the muscles will be fixed in a tetanic contraction as long as the electrode is on the motor point, and the intensity of the contraction will be exactly proportioned to the E. M. F. of the current.

The patient can next reverse his arm, and place the extensor surface upon the stationary electrode. The operator need never look at any chart of electro-therapeutic anatomy, for assistance to locate motor points. Every movement of the fingers, wrist, elbow, and of the muscles acting upon them, can be practically demonstrated on the patient, without any previous knowledge of charts and diagrams.

It is a simple matter to go over the entire arm in this way. By placing a stationary electrode upon the back of the neck, another electrode may be moved over the sides of the neck and face, and the motor points of these regions located on any person whenever it is desired to do so.

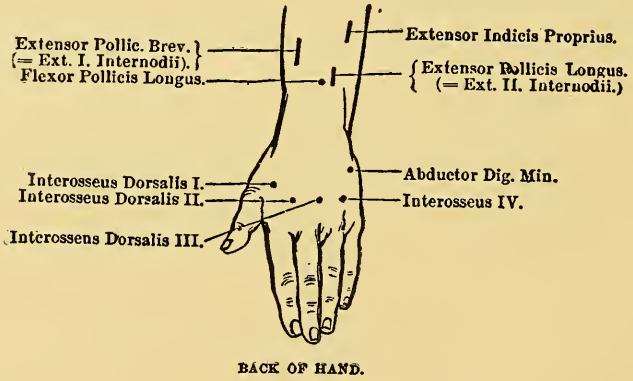


Fig. 26.

With the patient recumbent, and a positive flat electrode under the abdomen, a labile negative electrode may be moved over the area of the back, and its motor points located at will.

By turning the patient over, and putting the positive electrode under the cervical spine, or sacrum, the motor points of the anterior trunk may be demonstrated by the labile electrode as it passes over muscles.

By standing the patient upon a foot-plate, and promenading an electrode up and down each limb from the hip to the ankles, the motor points of the leg can be easily traced.

Once witnessed, this method does away with all future

doubt and difficulty about the location of any motor point, and obviates the necessity of anatomical charts. There is neither pain nor discomfort to the patient, and the motor point can be found in less time than one could find it in a chart in a book.

The physician, however, may inquire if it is necessary to know where motor points are located. In practice, no physician is compelled to either examine charts, or burden his mind with any attempt to remember any of these locations. The importance of an exact knowledge of motor points was immensely exaggerated by early teachers of localized

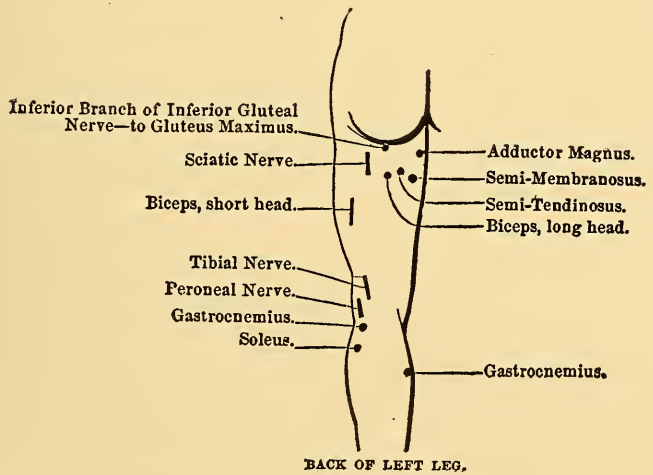


Fig. 27.

methods of treatment, who were proud of their skill in placing a metallic point electrode upon the exact spot on a patient's body which would cause a given muscle to contract with a special current. This skill may have been evidence of their patience and industry, but it cuts a small figure in the practical electro-therapeutics of to-day.

It is sufficient to know that motor points exist. They are wanted only once in a while. They can then be found during the actual treatment, without any previous investigation, and

as a matter of fact, the process which discovers them is the treatment itself, so that no other knowledge of motor points has any bearing on the treatment.

The "diagnosing electrode" and the "motor point chart" are two things which need not trouble the general practitioner. A very large part of the work which gave motor points their early fame is now done in simpler ways which require no disrobing of the patients and no reference to a chart. Nine-tenths of the best work in electro-therapeutics is done without any practical regard for motor points, and when we want them, we may easily find them by the sweep of an electrode.

The static machine effectually disposes of an immense amount of the labor formerly done by enthusiasts who tried to cover all applications with galvanic and faradic currents.

Pelvic Diseases.—Owing to the general complacency with which an explorative laparatomy is regarded at the present time, by all parties concerned, *except the patient*, it might be supposed that the suggestion of any other diagnostic method is superfluous. It is reasonable, however, that the position taken by Apostoli and successfully maintained by him for so many years, in regard to the pre-operative study of galvanic reaction, should be familiar to physicians. The importance of the subject and the value of illustrative clinical cases justifies incorporating into this chapter a portion of one of Apostoli's own reports which should be studied by the reader.

The important fact, which I presented to you last October, drawn from the post-operatory galvanic reaction based on the *state of the uterus*, properly so-called, answered this question: Are there fibromata on which we should operate, and which absolutely demand surgical intervention?

To-day I will consider only the uterine periphery, and show you what galvanism tells of the adnexa, if diseased, and to what degree; if, given a cystic tumor, it is suppurative or simply serous; if, in a word, conservative methods may be used or if a radical operation is demanded; and, in the latter case, whether a vaginal or abdominal operation be preferable.

The cases I shall give shall be the best demonstration:

CASE I. *Résumé.*—Woman, twenty-nine years old, lymphatic and very nervous, ill five years with a double inflammation of the adnexa, following probably a miscarriage occurring in 1881. No result from the classic treatment (vesication). Partial but not complete amelioration by a first electrical treatment given from 1886 to 1887 (nine intra-uterine galvano-caustics and a vaginal galvano-puncture). Suspension of all treatment for seven years, and continuation of the same anatomical and symptomatic situation. In July, 1894, verification of a tumor of the adnexa, painful to the touch and quite hard, filling the Douglas *cul-de-sac*. Is it suppurative, inflammatory, or simply cystic? The diagnostic point elucidated by the galvanic treatment, from the 29th September to 24th November, 1894, sixteen positive intra-uterine galvano-caustics, varying from 50 to 90 ma., and finally one single negative intra-uterine galvano-caustic, at 70 ma., neither febrile reaction after the operation nor marked symptomatic amelioration. Laparotomy obligatory. Confirmation of the galvanic diagnosis before the operation. Cystic tumor serous, large, from the right tube, without traces of suppuration or recent inflammation of the adnexa.

Diagnosis.—I was called in consultation the 29th November, 1886, and I discovered inflammation in both adnexa, more acute to the right, with very marked infiltration in the Douglas *cul-de-sac*.

First Electrical Treatment.—From the 11th December, 1886, to 21st February, 1887, I applied nine negative intra-uterine galvano-caustics, small dose, averaging 20 to 30 ma., and for five minutes each time. All these treatments, made at the house of the patient, who was in bed, were generally well tolerated, and were not followed by any very marked post-operatory reaction. On the 25th February, 1887, a complementary negative galvano-puncture was made in the Douglas *cul-de-sac*, under chloroform, a filliform trocar being introduced several millimetres, in the centre, at the seat of inflammation lying in the Douglas *cul-de-sac*, and to the right. All these electrical operations, in which there were no unpleasant incidents, were followed by a partial recovery, which unhappily was not complete, on account of the interruption of the treatment caused by her departure from Paris. From this moment all active treatment was suspended during the seven years which she was not in Paris, and the frequent news which she wrote me from time to time showed that her physical condition remained about the same. Always the same pains, the same weakness when walking, almost constantly in bed fourteen days in the month, and the same alternacy of crises followed by rare periods of remission. The only symptomatic change which followed

the galvanic puncture, and which was durable was the disappearance of pain the moment the menstruation commenced. This was the time that she felt the best, especially before the menstruating, when an amelioration set in to end with the menses.

Then she decided to return to consult me, and to complete the treatment which had been interrupted seven years ago.

Actual State, 17th July, 1894.—For three months she suffered more on the right side, to which were added lumbar pains. Sometimes, more rarely, she suffered in the left side. She complained at the same time of heartburn, nausea, of megrim, and of very frequent headaches, and felt a pain in the right hypogastrium, "an engorgement," she called it, with a weight at the rectum, to which she, being very constipated, attributed all her trouble; besides she is very nervous, excessively impressionable, without, however, having hysterical crises.

Diagnosis.—Large uterus with an anteflexion and a right latero-version. A hard tumor in the adnexa, painful on examination, large, and adherent posteriorly. The uterus being pushed to the right, this tumor seemed to leave the left *cul-de-sac* and fill the Douglas *cul-de-sac* entirely, being lost behind the uterus in front of the sacrum.

This tumor is characterized, first by its large spherical development, then by its marked tenderness, and, finally, by its hardness in some places, while at others it scarcely felt like a solid tumor.

Undoubtedly it is a tumor of the adnexa, concerning which many important questions arise. Is it suppurative, inflammatory, or simply cystic? The answer to this question should determine the choice of treatment (conservative or surgical), and in the case of a radical operation, ought to decide absolutely for or against the vaginal or abdominal method. I saw at once, considering the history of the case, that probably only a radical operation would be effective; the necessity for it, however, not being immediate, I decided, on the formal invitation of the patient, to make a second electrical trial before abandoning all hope of conservation, and, though I was persuaded in advance of the probable futility, we would gain valuable data to establish the diagnosis.

Second Electrical Treatment.—The first, intra-uterine, galvano-caustic, + 40 ma., five minutes, on July 26, 1894, had no reaction except a little lassitude in the lower abdomen. The night and the day following were good, except for a little pain in the left side accompanying rising and sitting; the patient had just menstruated, and afterward was always better.

The second and third treatments, 50 ma. +, on the 28th and 31st July, were followed by no appreciable reaction. The patient went to the country on a vacation, and returned to the clinic September 29, 1894. During this absence of two months nothing particular happened. She complained always of her right side; the excitement of the return and of the tentative operation caused an intense migrane with repeated bilious vomiting, lasting forty-eight hours. She had already had two similar attacks, two and three years before, but they were less severe, and later she had another, quite intractable for three days, because a patient whose bed was next to hers was chloroformed. Sixteen more intra-uterine treatments (50, 70, 70, 90. 80, 60, 60, 50, 50, 40, 60, 50, 40, 35, 50, 40 ma.), usually of five minutes duration, were made about three times a week from September 29 to November 24, 1894; there was neither an intense operatory nor post-operatory reaction. The symptoms of the patient were not modified by the treatment; the same sickness persisted, making locomotion very difficult, with occasional intermission of varying intensity. Appetite good, but pain considerable at the right, though it did not disturb her sleep. Finally, on November 29, in order to demonstrate the absence of inflammation and of suppuration in the adnexa, and in order to study better the character of the post-operatory reaction, if one could be produced, we gave her for the first time—treatment 70 ma. for five minutes, the sound being pushed to the fundus. Although well tolerated, the séance was followed that night and the next day by pain in the entire abdomen, which felt, she said, like a tearing out of the abdomen and kidneys. There was, however, no fever nor anorexia; in a word, no manifestation of acute inflammation.

The only result was to advance by six days the menstruation, which was due the 10th of December, not surprising after a negative intra-uterine application.

The local electrical treatment being unsuccessful, from a symptomatic point of view, and having thus acquired a knowledge that I would not find a suppurating ovaro-salpingitis, I decided on an operation.

Report of the operation made by Dr. Le Bec, January 10, 1895.—On opening the peritoneum, adhesions of the omentum could be seen. The right tube did not seem very large, the left did not appear to be affected. Lace-like adhesions bound the intestine and had to be destroyed before they could be raised.

a. Left side.—Numerous adhesions between the intestine and the left tube. The left tube and ovary were abnormally high, the fimbriated extremity being fixed to the sacro-vertebral

synchondrosis by a fibrous band. No tumor of the tube, which appeared to be only catarrhal, though the ovary contained small cysts. No pus.

b. Right side.—The right tube distended, resembling a thin intestine, had its fimbriæ extending into the Douglas *cul-de-sac*, where it was fixed by easily broken adhesions. The ovary, which was intact, was also fixed by numerous adhesions to the uterine wall. The utero-ovarian ligament was much shortened. Finally, there were slight adhesions between the anterior and posterior walls of the uterus and the proximate organs, which could be readily broken with the fingers. The right tube, twelve centimetres long and ten in circumference, looked like a large sausage. It was filled with a transparent fluid which made it look like a vaginal hydrocele.

Conclusion.—Here, then, is an instructive case where the galvanic diagnosis has been confirmed by a subsequent laparotomy. The galvanic indications were very clear, stating that there was neither pus nor recent inflammatory processes, and, in fact, we have found no trace of a recent inflammation of the adnexa, and the cystic fluid in the tube was absolutely serous and transparent, without a trace of either local or peripheral suppuration. The many adhesions found were old, and not connected with any actual inflammatory process. This same pre-operatory behavior with galvanism ought in the future to affect our operations and, if not to stop them, at least to advise us to perform one less radical. Thus in a case of a non-suppurating tumor, projecting into the Douglas *cul-de-sac*, a simple incision in the posterior *cul-de-sac*, with the evacuation of the hydro-salpinx, would suffice to cure without the irremedial mutilation of the woman. In the case of a final failure, a second more radical operation could be made.

CASE II. (*résumé*). Woman of twenty-eight, with small, very hemorrhagic fibroid. Treatments from February, 1892, to September, 1894—fifty-one in all, intra-uterine galvano-caustic, usually with large dose. Symptomatic success at first; later, failure. Absence of marked post-operatory reaction, and the integrity of the adnexa demonstrated by this galvanic treatment. Final malignant degeneration of cervix. Same intra-uterine galvanic tolerance preserved. Abdominal hysterectomy. No trace of lesion of adnexa, and confirmation of the pre-operatory diagnosis.

Mme. L., æt. forty-eight, washwoman; one child, twenty-seven years old. January 30, 1892, sent to Dr. Apostoli's clinic by Dr. Gernard; had been ill for some years. The symptoms were as follows:

Actual symptoms.—1. Continuous abdominal pain, especially

on the right side, and extending into the rectal region. They are augmented by the least fatigue. (Began fifteen to eighteen months ago.) 2. Menorrhagia for four months, lasting ten to twelve days, confining the patient to her bed because of the quantity, but painless. 3. Much leucorrhœa, which had lasted for a long time.

Diagnosis.—On examination, a retro-placed uterus was found with an interstitial subperitoneal fibroid as large as a small orange, which hung down the posterior wall and resembled a retroflexion. No inflammation of the adnexa. Depth 8½ centimeters.

The treatment, commencing February 4, 1892, can be divided into three periods, separated by different intervals.

First period.—Until the 13th of August, 1893. From the beginning six + intra-uterine galvanic treatments, five minutes each time, the doses being 50, 120, 165, 100, 75, 100 ma. It was always well tolerated, and without too much post-operatory reaction.

Then twenty-eight intra-uterine applications of the alternating sinusoidal current were given. The result, as far as the pain and leucorrhœa was concerned, was favorable, but did not still the hemorrhage, probably on account of the insufficient hemostatic action of the alternating current. Two menorrhagias occurred during the two months when the treatment was interrupted (August and September), but in spite of that, the general condition of the patient was sensibly improved (better appearance, more strength, and could walk better).

Second period.—The treatment was recommenced October 13, 1892, + galvanism 140 ma., five minutes, which was well borne and without painful post-operatory reaction. Then from the 20th of October to December 13, six alternating treatments. Finally, the hemorrhage and leucorrhœa having returned, galvanism was resumed. From December 15 to July 13, 1893, + galvanism was given twenty-nine times. Dose 145, 170, 100, 150, 140, 165, 80, 125, 150, 140, 150, 150, 140, 150, 135, 135, 145, 140, 145, 120, 130, 125, 125, 130, 130, 130, 110, 145, 60, 100 ma. Five minutes on an average.

As usual, I kept a complete record, and no evidence of either painful or febrile post-operatory reaction was shown. Treatments were three times a week, or every other day.

This treatment helped the hemorrhage, though slowly; menses were regular or late, and less abundant, and in July, 1893, they were delayed thirteen days, which had never before occurred with her. The general health was fair, locomotion easier, sleep good, and the anterior pain seemed to have disap-

peared; nevertheless a slight flow, leuchorrhœa, or hydrorrhea, persisted.

A phlebitis, which confined the patient to bed for six weeks, interrupted the treatment for three and one-half months.

The amelioration of the hemorrhage lasted two months after the last treatment (July and August), the menses being normal. But by October the menorrhagia was marked.

Third period.—Patient returned to the clinic in November, 1893. The tumor had not increased in size. The anatomical situation appeared to be the same, probably without phlegmasia of the adnexa.

Then ten treatments were given, from November 2, 1893, to January 11, 1894. The doses being 100, 100, 110, 100, 110, 140, 85, 105, 110, 100 ma., for five minutes. No marked reaction. The hemorrhage continued and a new symptom appeared. A gray, watery discharge, mixed with pus, and having a foul odor.

As the menorrhagia relapsed so frequently, the intra-uterine treatment seemed ineffectual, and as the tumor was readily accessible, galvano-puncture was tried.

A new gold trocar, insulated to a few millimetres from the end, permits through its insulation, a large quantity, without much pain or scarring of the vagina, and avoids all danger of a subsequent septicæmia.

On January 30 and May 8, 1894, + galvano-punctures were made without anæsthesia, 100 and 140 ma. being given. Though they were well supported they did not seem to benefit the patient. Then uterine treatment was suspended for two months, and the improvement of the depressed general health was attempted by means of baths with rapidly alternating currents.

But the persistence of the hydrorrhea necessitated the resumption of the galvanism. Renal pain, extending to the sides of the abdomen, had returned. September 18, forty-seventh + galvanic treatment, 70 ma., five minutes, well supported. September 20, 22, 25, and 27, 100, 110, 180, 200 ma. were given respectively. All well supported.

All the operations had been well borne and without marked post-operatory reaction, though the sound was always 7–8 cm. in the uterus, but there were no results. A last examination, on December 23, 1894, confirmed the fears I had had for a year.

The final failure of intra-uterine galvanism patiently given, and well borne, as well as the appearance of an abundant and fetid hydrorrhea, had made me suspect a malignant degeneration, which was slow to show itself externally.

But by the end of December a false diagnosis was impossible. I at once advised her to be operated upon, and on the 10th of January Dr. Le Bec performed an abdominal hysterectomy.

Report of the Operation.—I found a large fibroid growing from the fundus: a smaller one was found at the left.

Numerous adhesions bound the mesentery and even the intestine to the tumor. The adnexa were high, and pushed back. I made a total extirpation by the method I had adopted.

Examination of Tumor.—Adhesions, which show no signs of inflammation. The cancer limited to the cervix, extending to the internal os, but not above. The cervical canal dilated, its walls degenerated. The uterine body enlarged by a fibroma, growing posteriorly, and interstitial tumors which show microscopically all the characters of the classical fibroid, without any signs of degeneration. *The adnexa normal, without signs of recent or old inflammatory processes.*

Conclusions.—The bimanual examination showed a woman without inflammation of the adnexa. The only manifest lesion was a fibroid, apparently simple. But we know that laparotomies frequently reveal the inadequacy of bimanual examination. Therefore I have sought in the electrical application a more certain method of diagnosis, and I think it has the precedence of the bimanual examination. Here the two methods agreed in stating that there was no inflammation of the adnexa. This was substantiated by the laparotomy, and shows the importance I give to value of the testimony of galvanism, applied patiently, methodically, and wisely. But, in the last year, the galvanism acquired a further interest, from the degeneration of the cervix, with the conservation of the integrity of the uterine body. The progressive cachexia caused by the malignant degeneration could, *à priori*, be expected to stop the treatment. Actually it did not do so, and this case shows us what we already know, that the condition of the adnexa partly regulates the galvanic tolerance, and further, that this tolerance is not directly influenced by the localized degeneration of the cervix, though the contrary is true in the degeneration of the entire body, as I demonstrated to you last October.

CHAPTER XV.

TREATMENT OF PELVIC DISEASES.

Chief clinical methods. Percutaneous galvanism. Vaginal bipolar faradization. The technique of bipolar sedation. Duration and frequency of treatment. Vaginal bipolar stimulation. Clinical hints. Intra-uterine bipolar applications. Massage and electricity in gynecology. Faradic apparatus for pelvic practice. Galvanic precautions. How to regulate galvanic dosage with large currents. Aids to the diagnosis of pelvic lesions. Indications for electricity in gynecology. Intra-uterine "cauterization."

THE major part of **Gynecological electro-therapeutics** involves skill in the selection, management, manipulation, and modification of but **Four Chief Methods** of employing currents.

1. External method, the percutaneous administration of a galvanic current through the pelvis.

2. Vaginal faradic method (bipolar faradization).

3. Galvanic currents employed with one electrode in the vagina and the other externally.

4. Galvanic currents employed with one electrode in the uterus and the other externally.

The teachings of the electro-physiology of galvanic and improved induction coil currents, together with clinical experience, have rendered the choice of these methods and the selection of poles and regulation of dose, a simple and fairly exact matter.

In addition to these four leading methods of practice the faradic current is sometimes applied with one electrode in either the vagina or uterus, and one externally on the abdomen or lower spine, and metallic electrolysis is also superimposed upon galvanic current action—but the physician who can adapt these four methods to functional derangements or pathological states may be said to command nearly all the aid that medical elec-

tricity can furnish to medical and surgical gynecology by local applications.

Beyond these local methods there are also general benefits to be derived from a well handled static machine, and beyond these are the surgical uses of electro-cautery. The experimental stage of methods of treatment has passed, and experience has amply demonstrated that no practitioner can afford to dispense with the help of medical electricity in the routine treatment of the diseases of women.

Owing to the elaborate terminology of pelvic affections the list of lesions treatable by electricity in all its forms seems a long one to the physician who has been familiar with the action of any one current alone. Moreover the general custom of referring to indications and applications in an indefinite manner has left the practitioner in doubt as to the form of current, polarity, electrodes, dosage, and other essential particulars, so that gynecological electro-therapeutics has appeared to many to be as delusive as the mirage of the desert—a vague, difficult, whimsically mixed uncertainty of doubtful methods, with nothing but a trail of guesswork to guide the operator to results.

Such was the state of affairs in 1885, but it does not apply to 1897. As a matter of fact gynecology not only constitutes the most useful local field of electro-therapeutics, but the apparatus required and the exact work each type of current will perform within the pelvis is more definitely mapped out, understood, and applied, than in any other branch of medical electricity.

When, however, at the beginning of his experience the choice of one of the four chief methods of employing direct and induced currents for the relief of pelvic symptoms or disease, cannot be made at sight by the physician he can often solve the problem of treatment as he sometimes solves the problem of diagnosis—by exclusion.

He will rarely make a mistake if he initiates treatment with either *bipolar vaginal sedation*, or the sedative-tonic action of *percutaneous galvanism* in cases in which pain and tenderness

are marked symptoms. These two methods possess great value with practically no possibilities of harm, and are always available at the first visit of the patient.

During the period of a woman's functional activity she is liable to pelvic diseases which circumstances make it hard to cure, and relapses which it is hard to prevent. It is as injudicious to rely upon electricity alone in the treatment of these difficult affections as it would be preposterous to rely upon any other single agent, however valuable. Electricity has, however, demonstrated his title to rank first among conservative remedies —with no other agent of its class in sight.

During the ten years between 1884 and 1894 the practical possibilities and reliable utility of galvanic and fine induction coil currents were very fully developed by clinicians of unrivalled experience, at the head of whom stands the honored Apostoli; so that for several years past the status of these currents has been fully established for general recognition and employment.

Methods of technique are no longer in a nascent state of change, but have become more definitely determined than the accuracy of diagnosticians. Electricity has demonstrated its physiological and therapeutic actions and now stands ready to be employed. Many of the problems of the transition period of gynecological electro-therapeutics have been substantially settled since the first years during which improved induction coil apparatus were made available and the correct dosage of galvanic currents ascertained. In the chapters that follow I describe each application with full and explicit detail, and have presented a great variety of different clinical conditions so that the physician can turn to these pages for practical help in the treatment of his own cases.

Topical Routines of Gynecology.—Some of the procedures which have been, and still are, recommended for pelvic conditions especially amenable to proper electro-therapeutics are medical crudities if not actual barbarism. The best gynecological methods of employing electric currents supplant a large

part of time-honored and unsatisfactory measures. No one who is familiar with the practical utility of the half dozen electrical methods which successfully relieve a great percentage of the ordinary diseases of women can fail to wonder at many of the inferior methods of practice retained to the exclusion of electricity in the routines of gynecologists.

I hold very decidedly to the view that no physician or surgeon who assumes to treat the diseases of women can do his patients justice without the help of electricity. No careful operator for instance, can afford to remain unacquainted with such a simple and valuable therapeutic method as *bipolar faradization*. If compelled to choose between the efficient remedy thus supplied by a single vaginal bipolar electrode and a high tension induction coil apparatus, and ordinary resources of local medication, ointments, suppositories, pencils, solutions, iodine, and pessaries, and a considerable number of minor surgical operations, I would deem it a lucky trade to swap them for the battery and the electrode.

Both induction coil and galvanic currents are remedies of *very great practical value*, and are within comparatively easy reach not only of the specialist but of the general practitioner who will give the matter reasonable study.

Having attained a practical settlement of disputed questions of apparatus and technique, and progressed out of the experimental stage of electro-therapeutics it is certain that no intelligent physician, no graduate of any reputable medical college, no practitioner who strives faithfully to secure the best clinical results, can now fail to give his patients the benefit of the splendid capabilities of electric currents in the treatment of pelvic diseases. Their great value cannot be ignored. The benefits which can be produced by the simple methods described in this book speak for themselves whenever they are witnessed. In many cases the patient is promptly relieved without inconvenience, confinement in bed, or troublesome restrictions upon her daily habits, when in similar cases other remedies and methods of treatment supported by eminent authorities are

irksome, full of trouble, often associated with suffering, and end in unsatisfactory results.

I do not see how a physician can reconcile himself to the neglect of means which will successfully relieve ninety out of every hundred cases of ordinary dysmenorrhea.

I do not see how a physician can fail to seek the means of relieving almost all the forms of pain which spring from derangements within the pelvis like the manifold miseries out of Pandora's box.

I do not see how any one who consults his own professional interests can neglect the chief remedy against endometritis and the majority of its accompanying evils.

An electric current which will almost infallibly conquer subinvolution and chronic metritis is valuable. The means of restoring strength to weakened supports of the uterus, of correcting recent displacements and removing the effects of chronic alterations is a practical boon to patients.

And so we might go on, omitting all that can be said of the uses of electric currents in rare and grave lesions, and confining our remarks to cases in every day practice,—cases of functional neuroses, of pain, congestion, inflammation, hemorrhagic conditions, amenorrhea, versions and flexions, subinvolution, prolapsus, minor lacerations, and atonic states, with associated anemias, neurasthenias, dyspepsias, headaches, backaches, and the wide range of symptomatology which suffering womankind presents,—we find that in galvanic, high tension induction coil, and static currents we often possess the most practical means of relief within the domain of medicine. If these electric currents possessed no other power than their demonstrated ability to improve nutrition, dislodge pain, control hemorrhage and afford prompt, grateful, and lasting symptomatic relief in a score of obstinate pathological conditions we should say they were indispensable in office practice.

I am convinced that they *are indispensable*. Treatment of the diseases of women without the aid of improved electrical apparatus is not satisfactory treatment either to patient or

physician. Leave electricity out of gynecology and we have the play of Hamlet with Hamlet left out. It is only when general and local prescribing and electrical currents join friendly hands and supplement each other that the best clinical results are attained.

External Galvanic Method. "Percutaneous Galvanism." This constitutes a general sedative-tonic, nutritional and alterative treatment for the pelvic viscera in anæmic and neurasthenic cases, especially with vague general pains and derangements of menstruation. It is extremely agreeable to patients and has a powerful tonic action.

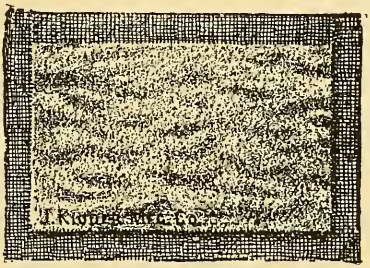


Fig. 28. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Place the patient in the usual dorsal position upon the operating table. Select two similar felt-covered electrodes of medium or large size (6×8, or 7×9). Saturate them in a two per cent. solution of soda-bicarbonate as hot as they can be handled, and press them sufficiently dry to prevent wetting the patient's clothes. These electrodes should never be pressed as dry as possible, but must be allowed to retain the maximum amount of moisture short of dripping.

Place one of these electrodes under the lumbo-sacral spine, where it will be kept in close contact with the tissues by the pressure of the patient upon it. The electrode is backed with rubber, but pressure will spread the moisture of the felt out of the electrode at all sides, and the protection of a thickly

folded towel should be placed between it and the patient's clothing.

Place the other electrode across the lower abdomen, and the firm contact which is absolutely necessary may be maintained by the weight of a small bag containing sand or shot, or the patient may be requested to press the broad palms of her hands upon the pad to hold it firmly down.

Connect the posterior electrode with the positive pole and the anterior electrode with the negative, in the absence of special indications for the reverse.

Increase the constant galvanic current gradually from zero up to 20 mil. In five minutes again increase the current to about 30 mil. This should be perfectly comfortable to the patient. Never cause a burning sensation that is annoying. If a mild current causes burning examine the skin, and if any abrasion or eruptive state is found to account for the irritation protect the spot with a piece of adhesive plaster to insulate it.

Hold the maximum current strength for about ten minutes, and reduce slowly to 20 mil. In three minutes more reduce the current gradually to zero.

Without disturbing the electrodes switch the automatic rheotome into circuit, regulated to about 100 interruptions per minute. Again increase the current strength from zero up to the point of producing moderately strong, but entirely agreeable, pulsations through the parts. In from three to five minutes reduce the current to zero, remove the electrodes, dry the surface of the skin with a soft towel and dust with toilet powder—a very grateful finish to the *sèance* in private practice.

If the abdomen is tender, and pelvic congestion exists instead of anæmia, reverse the polarity and place the positive electrode over the abdomen. If any condition is present which contra-indicates the tonic muscular contractions caused by the interrupted current, they may be omitted and the sitting limited to the constant current alone.

This method is useful in the treatment of unmarried women and of other patients in which definite indications for intra-pelvic electrodes are not clearly presented to the practitioner at the first visit without further study of the case. It is therefore exceedingly valuable as an introductory treatment, especially with patients who have been somewhat timid and fearful that they will be hurt. Its soothing and tranquillizing effects upon the nervous system and the mind would be sufficient to establish its value as a splendid therapeutic measure if it contributed very little benefit of other kinds.

It is also a useful intercurrent alterative tonic, when intra-uterine applications are only made at intervals of six or ten days.

In a case with troublesome symptoms and yet no pronounced pathology to account for them it is one of the best methods by which to begin the treatment, and continue it until indications are determined for more exact localization of method. It possesses the still further advantage that it is admissible and is acceptable to the patient in the class of cases who are unwell pretty near all the time, and who are sadly in need of treatment but are reluctant to attend until they stop oozing.

Percutaneous applications are usually repeated three times a week, although they may be administered daily with benefit during the first week of treatment if the patient consents and if speedy effects are desired. Their interesting possibilities in general bleeding states are illustrated by the following case:

January 17, 1894, Mrs. ——, age 26, married six years; no children; menstruated at 13. Regular until two months ago; then noticed a continuous show of blood, increasing during the last fortnight into decided hemorrhage, with severe backache. She presented the appearance of grave disease and advanced age; was in a state of complete mental and physical prostration, crying and frightened, and as hyperæsthetic as if she was in the agonies of acute strychnine poisoning. She

had just been bluntly told by a doctor on whom she called that "she had a cancer, and unless she had it cut out at once she would not be alive in three weeks." The horrible information threw her into a state of collapse, and an examination was out of the question. Fortunately, the tonic and sedative influence of static electricity may be availed of without touching the patient or removing any garments. After a soothing application and encouraging advice, she went home free from pain, slept restfully and regained composure. An internal examination was purposely avoided, while she was diverted from thoughts of cancer and told that it would be time enough in a month or so to find out what was the matter with her. Bovinine was added to her nourishment, and her electrical treatment directed to relieving the backache, improving nutrition and nerve tone and reducing the hemorrhage. Daily static electrization was given for fifteen minutes, and percutaneous, lumbo-abdominal applications of 20 to 40 mil. constant current were administered by my able associate, Dr. Fannie W. Oakey, who assumed charge of the case. On the fifth day the hemorrhage was entirely under control, the backache had yielded, as backaches always do, to the mild static spark, and, although an alarm of fire occurred in her home on the 23d, and caused a temporary aggravation of symptoms, she made such steady progress as to raise her hopes that the idea of cancer was a mistake. January 29, record reads: "No oozing; has slight backache late in evening if fatigued during the day, but it leaves on going to bed; all other symptoms are removed; she sleeps well and feels fine." On the 31st she had some uterine oozing of blood for a single day. February 15, after 11 treatments since January 22 (sixteen in all), she became unwell. On the 19th she reported: "Menses about normal this time; best period in four months; three days' regular flow, drying up naturally on the fourth day. Had some pain, but have always had it when menstruating." Five more treatments carried her up to March 7, when color had returned to her face, and she felt and seemed, to all appearances, in good condition to be examined and know the worst.

A microscopic examination confirmed a diagnosis of epithelioma of the cervix. Her husband was at once informed of the diagnosis and advised to arrange an early operation, and electrical treatment was stopped. I never saw her again. The operation, performed in one of the hospitals of New York, proved fatal. Under the circumstances of her peculiar case, I do not know what other agencies could have been employed to equal the comfort or surpass the benefit she

derived from the application of electricity, by only general methods, during the month which prepared her so well for—death.

There are other useful services performed for patients by this simple method which will be noted in the succeeding chapters. By skilful dose regulation all the way from 10 mil. up to 100 mil. the effects may be varied to suit the object aimed at.

Vaginal Bipolar Faradization.—In instructing physicians in practical electro-therapeutics I have been accustomed to point out the remarkable attributes of the vaginal bipolar electrode, and the useful services it renders.

Few are aware of its great value. References to its use are

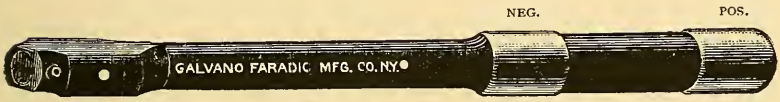


Fig. 29. A proper bipolar electrode.

Fig. 30. An improper bipolar electrode.

obscured amid the generalities of electro-medical writings, but it deserves a special prominence, for it is the gem of distinctly faradic electrodes, and is the means of securing unique and precious effects within the pelvis. Through its development and the improvement of high-tension induction coil apparatus faradic currents reach the high-water mark of their utility in gynecological practice. It is a comfort alike to patient and physician, for it involves no unfastening or removal of gar

ments, no wet pad upon the skin, no "getting ready," and no demand upon special instrumental skill.

The general practitioner can, with the very simple care and knowledge which is requisite, employ it as satisfactorily as the most eminent gynecologist, and an appreciation of its services grows constantly with use.

The bipolar method must never be employed with the current from any faradic battery possessing the coarse spring vibrator found upon all ordinary apparatus. It must never be employed with the crudely constructed coils which are furnished with about all the faradic batteries which cost from thirty down to two dollars and a half, and the injurious effects which may be produced in inflammatory cases with an improper coil are even less important to consider than the effects of the irregular, jerky, and rasping, irritating interruptions caused by the coarse vibrator in general use.

The electrode itself must be properly proportioned and light in weight, and all others must be discarded. Both the electrode and the current must be suited to the therapeutic work in hand, and refined results cannot be expected from coarse and non-therapeutic apparatus. Compromise is absolutely impossible in this field of work. The apparatus must either be the best obtainable, or it must not be used at all. There is no middle ground.

The beautiful resources of the bipolar method unfold themselves exquisitely in electro-physiological studies. Every variation in the current, the coil, and the rate and character of interruption lends variety to their manifold effects. Just as, in hydro-therapy the applications of water in different doses of temperature, rate, and volume produce different or opposite effects, so in electro-therapeutics the variability of dosage gives us control of a wide range of effects upon the circulatory, nervous, and muscular tissues of the pelvic cavity.

Among the clinical effects within the compass of vaginal bipolar faradization are the sedation of irritable or painful states ; the relief of congestion and inflammation ; increase

of metabolism and nutrition; absorptive tissue changes with marked tonic effects upon the capillary and lymphatic circulation; and a general muscle, nerve and circulatory stimulation throughout all the organs influenced by the current. Pain of many varieties may be relieved, recent exudates may be absorbed, relaxed supports of the uterus may be toned up, congested ovaries and vessels may be relieved of their engorgment, deficient vaginal secretion may be restored, tenderness and spasm removed, and the symptomatic burdens of functional and mechanical derangements and non-suppurative pathological lesions may often be lightened wonderfully by this method alone, and especially when reinforced by galvanic current actions.

As an auxiliary to other measures it is also often invaluable when lesions are beyond its direct reach. Some of the phases of galvanic current action, which are indefinitely called *catalytic*, are present in these coil currents, and aid in the happy results produced.

The gradations of these results are given extreme range by adroit technique. The most directly opposite effects may be called in their narrowest sense *sedation* and *stimulation*, but along with these go delicate shadings of method which give the physician control, either partial or complete, over many of the states which bring suffering women to his office.

The Technique of Bipolar Sedation.—Place the patient upon the operating table in the usual dorsal position, with feet drawn up and knees apart, as for an ordinary digital examination. No speculum is employed, and no antiseptic irrigation of the vagina is necessary. Warm the bipolar electrode to about blood heat (generally by holding it enclosed in the palm of the hand while connecting the battery), lubricate the tip with plain vaseline, attach the *positive* cord to the tip end, and the *negative* cord to the inner half. Each maker indicates by some special mark the separate sides to which to attach the positive and negative cords. *Always have the rectum emptied first.*

Insert the electrode gently behind the uterus, and well up in the *cul-de-sac* as far as it will go without forcible pressure. Support it steadily during the *séance*, so that no muscular contraction or movement of the patient will cause it to slip out, but be careful to avoid pressing the thigh muscles. The tissues within the cavity are insensitive to induction currents, but *the tissues of the vulva are as sensitive to the same currents as is the eye to a cinder.* Have the electrode well inserted before any current is started, stop the current before the electrode is withdrawn, and never let an electrode bring a faradic current in contact with the tissues of the vulva. One experience with the agony caused by such an accident would lose the confidence of the patient forever.

Switch four or five cells, the rapid vibrator, and the 1,500-yard No. 36 coil in the circuit, with the current at zero. Gently increase the dose by means of the rheostat until the

Fig. 31. Bi-polar Vaginal Electrode.

patient feels the current perceptibly. Again evenly and gradually increase it to the point of producing a firm and comforting grasp upon the tissues. It is important to reach the maximum of current strength required for the effect, and neither go beyond it nor fall short. With a little experience the regulation to the point of exactness is very simple, but the beginner can only be instructed by practice.

If in attempting to reach full tolerance a little pain is caused, reduce the current instantly until pain ceases. Direct the positive tip of the electrode next against each painful point that can be detected by carefully shifting it from one ovarian region to the other. Regulate the dose to full comfortable tolerance, and hold the tip steadily upon the point of tenderness until it is relieved. (This will require perhaps five minutes or

less. If more than one such point is found, the treatment is the same for all).

As sedation increases with each moment of the action of the current the original maximum dose will soon be felt less strongly, or may cease to be felt at all in five or ten minutes. Gently increase the dose again until it reaches the maximum of the newly acquired tolerance. When the current again begins to be less perceptible close the sitting by a very slow and gradual reduction to zero through the rheostat. Sedative results require that the tissues be left at rest, and the withdrawal of the current must be without haste and devoid of any disturbing quality. When, after not less than three minutes spent in this final process of diminishing the current to zero, the *sèance* is complete, remove the electrode. A tampon may be inserted in suitable cases.

When the 1500 yard No. 36 coil has accomplished its work in a sensitive case and no longer provides sufficient current, or, if it is not at first adapted to cases of only moderate sensitiveness, the proper dose must be obtained by means of other coils, passing first to shorter coils of the No. 36 wire, and if these are still inadequate proceeding to the 800 yard No. 32 coil, which will usually be the maximum until improvement is well advanced. In any case and during any stage of treatment the regulation of the dose by means of one coil or another is a perfectly simple matter and wholly devoid of perplexity after a single moment's instruction in the technique.

Duration and frequency of treatment:

Vaginal bipolar sedation cannot be hurried and rarely can it be overdone, for although we can over-stimulate with electricity we cannot over-soothe. Very few cases can be properly treated in less than fifteen minutes. In chronic cases requiring sedative-tonic treatment rather than pure sedation the *séance* may be fifteen or twenty minutes, repeated three times a week.

In sub-acute cases, which are still able to visit the office, daily applications of from twenty to thirty minutes will pro-

duce the greatest improvement most speedily, after which the sittings may be three times a week and of less duration.

Recumbent rest for some little time after each treatment is a rational precaution to promote the greatest benefit, but in office practice this idea is very seldom carried out. As a rule the patient rises from the operating chair to walk or ride home immediately and resume her usual habits; nevertheless the efficacy of the treatment under such conditions does not seem to be much impaired. The results are often remarkably good and are seldom disappointing even when the necessities of the patient overtax her strength and put rest out of the question.

In a third class of cases, which the physician finds in bed with acute pelvic congestion or inflammation, the portable coil apparatus must be taken to the bedside and long applications of an hour or more, repeated two, three, or even four times a day if necessary, until the active process subsides. The duration of the application is governed by the effect, and it must be long enough to produce the effect, and should be repeated p. r. n.

If the hot douche, ice bag, salines, antipyretics and other local or systemic measures can be prescribed with benefit by the physician, none of them need be neglected, but the addition of bipolar faradic sedation consummates and completes the resources of therapeutics. Other remedies are useful in their place and every educated physician must prescribe from the sum of his knowledge, but as a therapeutic measure for the relief of pelvic pain, congestion, inflammation, and the resulting infiltrations and exudations, this administration of high-potential rapidly-interrupted induction-coil currents by the bipolar method is incomparable in kind and in effects with any other agent in the scope of medicine.

It is to be regarded, not only as a remedy against the symptoms of acute disease of the female pelvic organs, but as an actual curative agent in the conditions which are within the limits of its therapeutic properties, and scarcely less invalu-

able as an auxiliary to other measures when the disease has advanced beyond its sphere of action.

In yet other states when the condition is without hope of radical cure, and some surgical operation is considered necessary, bipolar faradization still serves an exceedingly useful purpose as a preparatory to the operation, by placing the patient in the best possible condition to endure it. It contributes to the success of the surgeon by improving greatly the local state of the tissues, the general nutrition, strength and nervous forces of the patient, and *would, if thoroughly employed and reinforced by the resources of galvanic current action, clear up the prognosis and save the patient from the knife, in a large percentage of the cases which are now submitted to operation.* After an operation it may be required again, to relieve lingering symptoms.

Vaginal bipolar stimulation :

Having carefully described the technique of applying *seda-*

Fig. 32. A proper bipolar electrode.

tive currents to the pelvic parts it requires only to be said that exactly the same method of bipolar application must be pursued up to the point of determining the maximum dose. The electrode is connected in the same way, inserted and supported in the same way, and beginning at zero the current is increased up to the point of tolerance in exactly the same manner as before.

Whether this tolerance be found with the current through a coil composed of No. 36 wire, No 32 wire, or No 21 wire in any of their assorted lengths from 2,500 yards down to 200 yards or less, the technique of dose regulation is the same. The parts will, of course, be much less sensitive than in conditions when sedation is desired, and they will tolerate a much

stronger and more concentrated current, just as a paralytic and numb limb will tolerate and require an application which would aggravate an inflamed joint.

When the dose of full comfortable tolerance is ascertained during the first moment or two of any sitting the further effect of stimulation may be conducted along any desired gradation from the gentlest possible tonic addition to the sedative action, up to exceedingly vigorous stimulation, muscular contraction, and excitement of the parts. The physician is informed both by diagnostic experience and by the effects produced during the treatment exactly how to measure the degree of stimulation required, and there is no guesswork about it. The methods are methods of precision.

The first step towards *moderate stimulation* is the gradual increase of current strength, as fast as the sensation lessens, so that the dosage of full tolerance is practically maintained during the entire *séance*. Instead of reducing the current to zero, slowly through the rheostat, at the close of the sitting it is now shut off abruptly by the cut-out switch. This leaves the tissues wakeful and alert instead of composed to rest, as the opposite method leaves them.

If the case is one requiring a *gentle tonic effect*, the current strength should not push to the extreme point of tolerance, and the sitting may last for fifteen or twenty minutes. It will partake very nearly of the nature of a sedative application, but while the gradual reduction of the current leaves the tissues in a state of rest, the abrupt stop of the same current results in a secondary reaction of a more tonic nature than the first method.

If a greater degree of *stimulation* is sought it is obtained partly by the more rapid hastening of each step of treatment, holding up the maximum dose quite firmly, for five minutes, pushing it to the strongest current the patient can bear for about two minutes more, and stopping abruptly.

Gradations of current strength and quickness in the manipulation will produce slightly different degrees of result, and

enable the operator to do just what he wants and no more. Always avoid pain and be warned by either pain or fatigue to reduce the current. Neither pain nor fatigue will ever be caused after the first few weeks of experience in the practice of this method, but the novice may occasionally be less careful, and may not correctly support the electrode. Never let the current run down the legs.

Still further stimulating effects may be imparted to the application by employing the undulating method for a couple of moments, at the close of the usual sitting. Having proceeded as before find the point of full tolerance with a steady current. Next produce a series of wave-like impulses of a momentarily stronger current by quick manipulation of the primary rheostat. As the resistance is suddenly and regularly shifted the current will rise and fall, and produce a series of rhythmical, powerful, and painless contractions, which cannot be equalled in character by the use of the slow interrupter.

Medical judgment must control these methods, in all their possible delicate shadings, and conform the technique to the needs of the individual case. I repeat that this is perfectly easy to do, and presents no difficulties in either theory or practice. The skill required may be obtained in a couple of hours provided the physician possesses the groundwork of familiarity with electro-medical currents.

If the operator is untrained in gynecology and bipolar technique, and *attempts to employ a common faradic battery for this purpose, he will lose every patient that he inflicts his experiments upon*, and he will think the merits of this treatment are here exaggerated. If he is reasonably expert, or makes himself so by clinical instruction, he will count bipolar faradization among his most cherished methods, and he will speedily discard and forever abandon the routine make-shifts of gynecology which it effectually supplants.

Short sittings, usually from five to ten or fifteen minutes, and repeated three or four times a week, are the usual rule

for effects of moderate stimulation, when the physician seeks mainly to improve nutrition, to break up adhesions, to promote the absorption of exudates, to tone up the uterine and vaginal tissues, to aid in the correction of sub-involution and prolapses, and produce general tonic effects.

Extreme stimulation with maximum currents, should not last more than three minutes, during part of any sitting, and should stop short of causing local fatigue.

Clinical Hints.—When once mastered the bipolar method is simplicity itself, but for the beginner there are some precautions which require emphasis.

With the vaginal bipolar electrode always use induction coil currents. Never use a galvanic current.

Always connect the tip terminal of the electrode with the positive pole of the battery.

Always employ a high grade and scientific induction apparatus with a finely adjustable rapid vibrator and full set of therapeutic coils. Never employ this method with any faradic battery which you are not certain is suited to intra-pelvic work.

Always keep the interrupting device brightly polished and accurately adjusted to a smooth and even action, for a badly neglected and imperfectly adjusted vibrator will destroy the efficiency of the best coil ever made.

Always retain the electrode to its full depth within the vagina; never allow it to slip out and touch the labia while the current is in action.

Always insert the electrode before starting the current, and always gradually increase the current strength from zero by means of the rheostat, which controls all currents to absolute zero at the commencement. Never suddenly make an alteration in the current during the treatment which will startle or pain the patient, and the author's secondary circuit rheostat obviates the liability of doing this.

Never employ a dosage that causes pain. All the good effects of this method are obtained without any pain whatever, and with decided comfort to the patient.

Always use the rapid vibrator, adjusted to its most rapid rate.

A clean vibrator will rarely stop during treatment, but a neglected vibrator will frequently stop. If this happens, always decrease the current before readjusting or starting it again. This avoids annoyance to the patient.

At the end of a stimulating application always shut off the current *suddenly*.

At the end of a sedative application always reduce the current gradually and slowly to zero.

Always, in every case, stop the current completely before withdrawing the electrode.

Never use an apparatus that does not possess an adjustable rapid vibrator, giving a smooth current, free from all irregularities, and of not less than three hundred periods per second.

Never *soak* the bipolar electrode in any solution. Cleanse it by quickly washing the lower two-thirds in a carbolic or creolin solution, but do not allow water to enter the holes in the handle in which the cord tips are inserted.

Always test a new electrode with the hand to make sure that the conducting and insulating parts work properly, as an accident in construction may either make it a mono-polar electrode, or defective in other ways. It is obvious that the effects of the current will be rendered nugatory if the electrode happens to be defective, and a simple test will prevent disappointment.

Always unload the rectum, and regulate the action of the bowels. *Never administer a vaginal bipolar faradic current with a loaded rectum.*

When directing the vaginal bipolar electrode be sure the tip is not pressing upon the muscles of the thigh. If the patient feels the current cramp the leg with a mild dosage, the current is side-tracked, and not going in the right direction. The true vaginal tolerance is far in excess of the tolerance of the thigh muscles, and the beginner must learn to put the electrode in the right place.

Intra-Uterine Bipolar Applications.—It will be observed that few references are made in this book to the treatment of patients by *intra-uterine* bipolar faradization. Probably the perusal of works on the subject would give the general practitioner the idea that there was little difference between vaginal and intra-uterine bipolar technique, and that one was employed indifferently as much as the other.

Theoretical advantages indeed belong to this direct method of affecting the uterine body, but in practice some of the electrodes manufactured for this purpose are difficult to render aseptic by either heat or the usual solutions. There is nothing germicidal about the action of the current from induction coils, and the dictates of prudence suggest that the intra-uterine bipolar electrode should be used with great caution, and only by an expert.

It is really seldom required, and it involves no hardship to regard the instrument as unsuited to the purposes of the general practitioner.

Fig. 33. Intra-uterine bipolar electrode. (Faradic.)

Moreover, the very conditions for which the intra-uterine application would be theoretically indicated are those in which we should often let it alone. When the canal is irritable, hyperæmic and sensitive, so as to need sedation, the most gentle insertion of an electrode is indiscreet, and the vaginal method answers the purpose of sedation quite efficiently. Experience will teach the operator to get along without very aggressive measures within the uterus.

In all references to bipolar methods in this volume it may be understood, unless otherwise stated, that the author refers to the vaginal electrode only. If it is desired to apply coil currents to the uterine cavity the mono-polar method, with a

metallic electrode which can be thoroughly sterilized, and a large dispersing electrode on the abdomen or under the sacrum, offers about all the advantages with none of the dangers that surround the use of an electrode which cannot easily be made surgically clean.

Massage in Gynecology.—A comparison between manual massage within the pelvis and the superior action of electrical massage and electrolysis may profitably be made by reading an abstract of reports such as follows:

M. Ponomareff has employed massage for different troubles of the pelvic organs of women. This method is indicated in the following maladies: Imperfect involution of the uterus after labor and especially after miscarriage. In this class of cases massage rapidly diminished the size of the uterus. It prevents hemorrhage as well as the development of chronic troubles. 2. Chronic metritis, before it reaches the point of sclerosis, but accompanied with endometritis and dysmenorrhœa. 3. Defective position of the uterus and ovaries. Massage acts favorably in these cases on the uterus and its ligaments, and thus permits a correction of the defective position of the pelvic organs. 4. Perimetritis and chronic parametritis are favorably influenced by massage; the exudates are reabsorbed, the adhesions become more pliable and very often disappear. 5. Gynecological massage is of great diagnostic value, as, for instance, when the demarcation is not very clear between the uterus and a benign tumor. By diminishing the congestion of the uterus, massage permits of a more precise diagnosis. The following are the cases in which gynecological massage is contra-indicated. (*a*) Pregnancy (normal and extra-uterine). (*b*) Malignant tumors of the pelvic organs. (*c*) All the diseases accompanied by suppuration, tubal blennorrhagia, and blennorrhagic perisalpingitis. (*d*) Acute febrile affections. The manual operation employed by the author was very simple; the finger, placed in the vagina or rectum, remains fixed and holds the diseased organ in place. With the hand placed on the abdomen, friction of the affected organ is executed across the abdominal wall, which ought to be relaxed as much as possible. The patient is placed in the dorsal decubitus, with the knees flexed. The *séances* should take place every day, or every other day, for a period of from five to ten minutes."

It will be seen that indications given for gynecological mas-

sage follow quite imperfectly the indications for vaginal bipolar faradizations. The crudity of the manual method and the objections to which it is open, offer decided contrast to the unobjectionable technique of the instrumental method. As regards therapeutic effects there is little to be said. One method belongs to the barbaric age of medicine, the other is among its most scientific achievements. The abuses of the manual method have caused it to be severely condemned, while the best results it secures, in the hands of an occasional master of technique, cannot be duplicated by one general practitioner out of ten thousand. The bipolar method need never be abused, demands no gift of genius and years of training for its best employment, and it will produce in the hands of every general practitioner who takes the trouble to get the electrode and the proper battery (and spend a few hours learning how to use them) all the valuable effects which make it indispensable in the treatment of pelvic diseases.

Faradic Apparatus for Pelvic Practice.—The common faradic battery is unfit for gynecological uses. The best faradic battery of the ordinary type is inferior, and if employed at all, requires to be supplemented by finer currents for sedative and anodyne effects in all cases in which congestion or inflammation is present.

An apparatus suited to produce all grades of sedative, tonic, nutritional, vaso-constrictor, stimulating and other therapeutic effects within the range of induction coil currents must be of a superior type. The author's apparatus is perfectly satisfactory. The compound high tension coil furnishes every variety of current included in the term faradic. It contains ample E. M. F., having six cells, any number of which can be separately employed. An excess of E. M. F. can always be used to keep the rapid vibrator in perfect action *while the rheostat in the secondary circuit controls all currents independently of the vibrator.* Every current therefore begins at zero, so far as the patient is concerned, and is regulated smoothly and absolutely without shock, to the required dose.

This is an immense convenience in vaginal applications. From actual zero to the maximum current which the most powerful coil and any E. M. F. from one to six cells delivers to the patient, the dose is regulated with absolute comfort by the improved rheostat which I designed three years ago, and

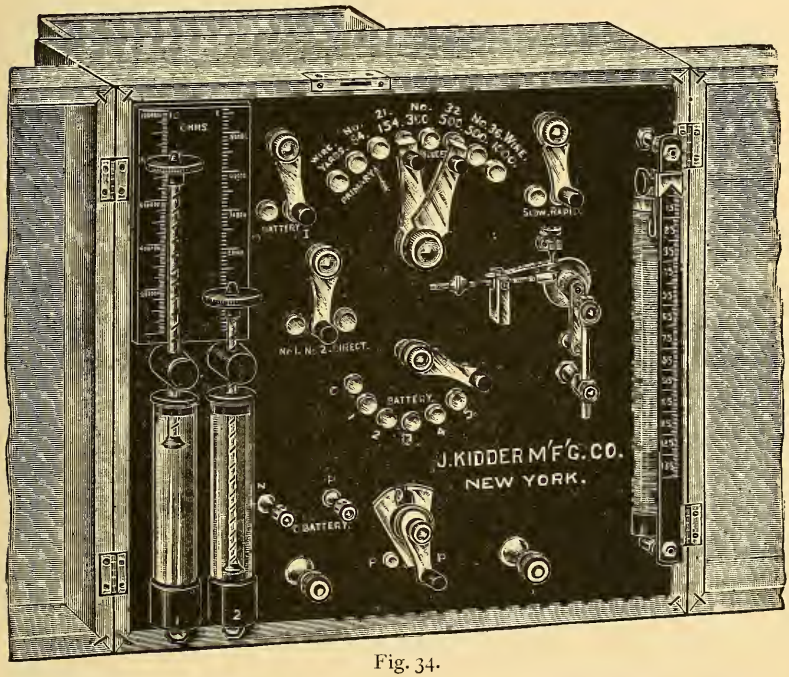


Fig. 34.

Author's Induction coil apparatus suited to all gynecological applications by bi-polar or mono-polar methods.

which has been found indispensable by all operators who are the fortunate possessors of this improved apparatus.

The rheostat is neither large nor costly, but is a simple pair of tubes of glass each containing a compound liquid resistance. The disagreeable irregularity in all common faradic currents bars them from use within the pelvis. Both the rapid and slow vibrator in the author's apparatus are completely adjustable and attain a maximum of evenness with ordinary care.

It is certain, therefore, that for at least three years a perfectly satisfactory high tension induction coil apparatus has been furnished the profession by the Jerome Kidder Mfg. Co., of New York City, and writers who at this late date are deploring their own lack of a suitable battery may be glad to learn that in the author's induction coil apparatus they have the means not only of obtaining the best results of coil currents in pelvic diseases, but require no other faradic battery for any other purposes which induction currents fulfil in therapeutics.

Galvanic Precautions.—Throughout this book it is understood that in all cases not otherwise stated, the felt, sponge, cotton, or clay, covering the external electrode is prepared for application to the patient by soaking it in hot water, to which about one or two per cent. of soda bicarbonate has been added, and never in plain water alone.

When saturated with this conducting solution the excess of moisture only should be squeezed out, leaving the felt or sponge as moist as possible, without dripping and wetting the patient's clothes. The electrode should be applied to the patient as hot as can be comfortably borne, and always at the beginning of the getting ready process, so that the tissues may become softened while other preparations for treatment are made. To prevent wetting the patient's clothes the electrode should be covered with a thick towel placed between it and the wearing apparel. Each electrode has also a rubber back.

Galvanic electrodes require all the moisture which they can retain without dripping, for the low voltage of the current makes the softening of the skin and the lessening of the external resistance a matter of great importance. Faradic electrodes may be simply damp, but a galvanic electrode must be *wet*.

The above facts will be repeated in the details of separate applications a sufficient number of times to serve as a reminder to the physician, but it will not be considered necessary to

mention them always, for they belong to the rudimentary A B C of the subject which all can understand from a single statement.

While it is necessary to state amperage in approximate doses in describing the various applications of galvanic currents, yet allowance must be made for the varying susceptibilities of the skin and mucous membrane. *The dosage must be regulated, not by figures but by effects.* Any amperage that produces the desired effect is the true dosage for the individual case, although some other person might require an increase or reduction of the amperage to obtain the same effects.

Conditions regulate the dosage, and experience teaches the operator to understand the conditions.

If the desired effect is a physiological action which requires a definitely ascertained amperage, there will probably be no other hindrance to its administration than a possible disagreeable sensation if the dispersing electrode is too small, or is not properly prepared to lessen the resistance of the skin. In all these cases a perfectly comfortable tolerance is easily secured by following the directions in this book.

In specific cases, when known intensities between 50, and 150 milliamperes are required to produce chemical cauterizing and other effects, the dosage must be reached, not against the tolerance of the patient so that suffering is caused, but by largely increasing the area of the external electrode, by carefully preparing the skin to the highest point of conductivity, and by employing electrodes of the best conducting material. In these cases tolerance for the dispersing electrode must be *created*, and without this precaution large currents cannot be administered. The lessons of practical experience become valuable to the operator in securing comfort to his patient when maximum doses are applied.

Always use precautions in withdrawing the positive intra-uterine electrode when using above 30 mil. Never pull it out abruptly, but reduce current to zero and reverse the current to loosen the tissues that clasp the electrode.

Antiseptic precautions:

In office practice a cleansing vaginal douche may be given before, and also after, some of the extreme cases in which intra-uterine applications require all possible precautions against sepsis. This double douche is very rarely needed. In all ordinary conditions it suffices to dip a pledget of cotton in a carbolic or creolin solution and swab out the vagina and cervical canal after inserting the clean speculum and before inserting the sterilized electrode.

This does not require stating repeatedly in the directions for each separate application, but will be understood by the physician to apply to all vaginal and uterine methods described. The electrode must be clean, but that belongs to the rudimentary knowledge of the use of instruments, and one mention of the fact is enough.

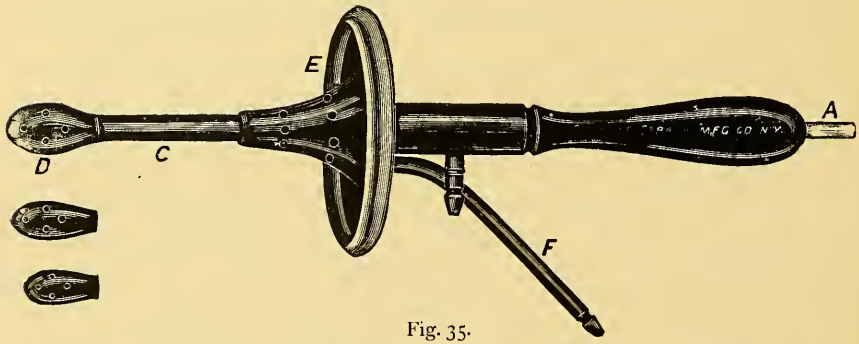


Fig. 35.

Electrode for Vaginal Hydro-Electric applications. Useful in pelvic exudates, ovaritis, vaginitis, vulvitis, eczema of the vulva, etc. Also for cleansing irrigation.

Antiseptic Irrigation of the Vagina.—In all cases in which vaginal irrigation is a wise precaution before an intra-uterine treatment, it is a neat point in practice to employ for this purpose the vaginal douche electrode. It is one of the most convenient and perfect means of giving a cleansing douche that can be employed, without any liability of wetting the patient's garments or the operator. The outflow F is directed into a pan on the shelf under the operating table in all cases, whether it is employed as a simple douche or as an electrode.

How to Regulate Current Strength to the Point of Maximum Tolerance with either Positive or Negative Galvanic Applications.—A knowledge of how to secure perfect tolerance at the dispersing electrode when employing large currents within the uterus, and the exact method of reaching the maximum dose, is of vital importance in successful practice.

With the electrodes in position and the dose already raised from zero to the point of decided sensation, continue to increase it gradually through the rheostat until possibly a slight pain is provoked. Pause for a moment and the irritation will usually disappear.

If the dose is still considerably below the desired amperage and the pain is felt only at the dispersing electrode, this must be increased in contact area provided that it has been saturated and prepared and applied in the proper manner as I have described elsewhere. If these conditions are correct and the irritability is the fault of an eruptive state of the skin, the electrode may be removed to the next most convenient and available situation, if it is possible to do so; but in intra-pelvic practice the external situations are practically limited to the abdomen and the lower spine.

If there is no fault of the skin, and if one large electrode is not sufficient, two can be easily applied with a bifurcated cord which connects them both to the same pole of the battery.

The conductivity of the skin can also be increased by previously shampooing it with hot water and soap, or ammonia, in the region where the electrode is to be placed.

With these precautions, which will be necessary if the amperage is to exceed 100, the current may again be advanced with little or no disagreeable sensation until we reach the point which actually determines the dose, *i. e.* consciousness of the current at the internal electrode. Until this is declared there has been no approach to full tolerance, for the toleration, great or little, at the dispersing electrode has nothing to do with the true dose regulation.

If still greater cauterizing action is desired cautiously in-

crease the amperage (after a moment) until actual pain is produced, and if this does not at once subside upon maintaining the same amperage for an instant, reduce the strength very slowly until the intensity ceases to tax the patient's endurance.

If this established amperage is sufficient to produce the desired therapeutic effect, there need be no further attempt to increase it, and it will become more comfortable during treatment instead of less so.

If it is still below the dose believed to be required, it is useless to attempt to increase it at the same sitting. We must wait until gradual improvement in the tissues during successive applications produces an increasing tolerance, and permits it to be safely done.

If tolerance decreases, instead of indicating an improvement by increasing in the usual manner, it is always a warning that the electro-therapeutist must heed. Either the dose has been too great, or the application has been improperly made, or some other treatment is indicated instead.

Pain during, or after, galvanic applications, is generally a signal for caution if it occurs at the internal electrode; otherwise, it is only a notice to use a larger and better conducting surface externally.

If pain unexpectedly follows any intra-uterine application of positive or negative galvanic currents of high intensity, the operator should immediately substitute the vaginal bipolar electrode and allay the irritability with long coil, faradic sedation. This will obviate almost all the aggravations the operator may cause while he is acquiring the intuitive skill which comes with practical training.

In the use of high intensity doses of constant currents the regularity of treatment may be interrupted by temporary complications, and no treatment which has resulted in irritation, either intentional or accidental, should be repeated until the effect of it has completely disappeared, and a milder dosage should be employed.

If irritation follows each attempt to pursue a special intra-

uterine treatment supposed to be indicated, be warned by it and substitute some other method which will produce good effects without irritation.

Aids to the Diagnosis of Pelvic Lesions.—If a patient complains of intense sensitiveness to manipulation, during an attempted digital examination, so that an acute congestive or inflammatory state is suspected, immediately insert a vaginal bipolar electrode, and test the greatest tolerance to a rapidly interrupted high tension coil current, that can be developed during about ten minutes. No matter how violent the patient may declare the pain to be, or how great the apparent tenderness to touch, the condition is not inflammatory if currents from medium coils with the full E. M. F. of three or four cells are comfortably tolerated.

If the pain and sensitiveness promptly disappears under one or several applications of bipolar faradic sedation, it was of a simple congestive or nervous character, or dependent upon some functional derangement which the action of coil currents control.

If only a comparatively weak current from the 1500 yard No 36 coil with less than the full E. M. F. of four cells is comfortably endured, and if the effect of sedation is more slowly accomplished and lasts but a short time after the sitting, the pain is probably due to an inflammation of the appendages, when it is referred by the patient to the ovarian region.

If ovarian pain does not progressively improve under eight or ten proper applications of vaginal bipolar faradic sedation, the lesion is probably not a simple chronic inflammation, but is complicated with organic disease of more serious nature.

If peri-uterine lesions are either suspected or unsuspected, or if their presence is ascertained but their nature not determined, a study of the tolerance or intolerance, of the intra-uterine galvanic dosage, during four or five experimental treatments will do much to establish the clinical diagnosis, or formulate the proper treatment.

If a first intra-uterine galvanic application is made, and the dose carried to the point of comfortable tolerance we may conclude:

1. If the tissues are intolerant, and cause pain and distress when the dose does not pass beyond 40 mil. there is some acute peri-uterine inflammation of either the appendages or the peritoneum, or of the pelvic cellular tissues.

2. The intensity, extent, and gravity, of the inflammatory lesion is generally *proportionate to the increase in the amperage of the current employed*, and in inverse ratio.

3. If it rapidly causes severe pain and febrile reaction after passing 40 or 50 mil. a suppurating process may be suspected.

If this intolerance is maintained during the entire treatment and does not abate, and is again manifested during the next similar experimental treatments, made two or three days later, and especially if the patient reports symptoms of chilliness and fever during the balance of the day following the sitting (or the next morning) it indicates that the inflammatory lesion is of a suppurative or other nature, which is incurable by conservative means. The application of intra-uterine currents of high intensity is therefore contra-indicated, but other palliative electrical measures may be employed, or an operation advised, according to the indications.

If the tissues manifest a better tolerance toward the end of a sitting than at the beginning, and if the patient experiences no other pains or distress except the normal "colic" of the *contracting* uterus after a strong positive application, and, if she continues to comfortably tolerate a *higher amperage* at each sitting, it is demonstrated that there is either no disease of the appendages or that any lesion of a chronic inflammatory character is simple and does not require operation. Such a case may be either radically or at least symptomatically cured by electrical treatment.

If (somewhat between these two classes) we find that the current causes more or less complaint *without febrile symptoms* the cause of the fictitious intolerance may be hysteria

which will be controlled by bipolar faradization and static electricity; or this kind of intolerance may occur in fibro-cystic tumors.

Simple cystic, peri-uterine tumors, which are neither inflamed nor suppurating (such as ovarian cysts and hydro-salpinx) may also show perfect tolerance of the galvanic current, and if not curable themselves by electrical treatment will not contra-indicate its employment for any other purposes for which it is especially indicated.

The study of the tolerance or intolerance of the intra-uterine galvanic current, and especially of the symptoms, if any occur within a few hours after the application, furnishes an immediate caution to the operator, and after several treatments given experimentally at intervals of two or three days, informs him of the condition with which he has to deal.

The same study of the results in cases in which the indications *modify, but do not reject electrical treatment*, will also determine rapidly (within eight or ten *séances*) the curability of the lesions, or their incurability by electrical methods, or the degree of symptomatic benefit which may be expected without a radical cure.

It thus decides very often: (1) when an operation is urgent; (2) when it may be indefinitely postponed, and (3) when it may be abstained from altogether.

It is the general consensus of opinion that the above teachings, which follow the immense experience of Apostoli, are reliable, and that many cuttings, exploratory operations, and various mutilations practised for the relief of ovarian pain, or for lesions of the appendages of uncertain nature, should be delayed or declined until all the resources of *faradic sedation* on the one hand, and of the *intra-uterine galvanic reaction* on the other, have been tried. These methods require only proper apparatus and reasonable skill to shed precious light upon the diagnosis, and thus serve both as priceless remedial agents, and as the defence of the patient against avoidable or injudicious surgery.

Indications for Electricity in Gynecology.—Questions on this point are regularly asked by many practitioners who first make no attempt to post themselves upon the A B C of medical electricity. The discussions in meetings of gynecological societies are fruitful of inquiries of this nature. Some of them expose the vagueness in which the neglect of medical colleges has left electro-therapeutics in the average medical mind. To many physicians electricity is something intangible, a haphazard agent, limited in action to stimulating muscles or producing heat, a sort of hit-or-miss therapeutic lottery, negligible altogether or to be tried only as a "last resort" when everything else has failed.

It may be laconically said that the indications for electricity are pretty well understood by those who understand them, but they are not understood by those who do not understand them. The multiplication table is plain enough to a child who understands it, but it is a hard matter to those who don't.

The true answer to a large question of this kind can be found by all physicians in the careful and intelligent study of the whole subject of electro-physiology and electro-therapeutics, and the qualities of difference imparted to electrical currents by different mechanical devices and by dose regulation. Those who stand afar off and regard the subject through the mists and the mirage of distance will be amazed to find how clear and explicit and exact the details of the subject become when they are inspected at close range. Not the least satisfactory part of the use of electrical currents is the clearness of the indications for each leading method.

But it is as well to ask what is the indication for administering water, without considering the methods of scientific hydrotherapy, as to ask this superficial question of electricity—as if it were a drug of but one preparation, one dose, one method of "taking," and no definite action whatever.

The apparent and ascertained indications for the use of electric currents in pelvic affections take into account the various demonstrated properties of galvanic, induction coil, and static

currents, and are governed in *practice* by the completeness or incompleteness of the physician's apparatus, and his skill in electrical technique. The disputes in open discussions of the subject do not arise from the essential difficulties of the subject, for few exist, but from the fact that two practitioners will not think alike if one has a modern, high-efficiency and complete equipment, and the other only a twenty or thirty-dollar "faradic" battery.

If the latter takes himself and his inferior battery seriously, he will be able to demonstrate that "he cannot secure the results claimed by enthusiastic operators," and plenty of his followers will believe that his experience proves electricity to be "over-rated."

The physician, however, who is equipped with a complete fifty or sixty-cell galvanic cabinet, meter, rheostat, and interrupter, a scientific coil apparatus giving the manifold variations of induction currents now at our command, a static machine of not less than six or eight plates, twenty-six, twenty-eight or thirty inches in diameter, and an assortment of from one to two hundred proper electrodes, and who is adept in the uses thereof, will state that he can select and beneficially apply some form of current in some properly regulated dose in every deviation from the normal health which is not distinctly within the province of either curative medicine or of the surgeon.

Such a practitioner will state that as compared with topical routines, still generally in vogue, the advancement of electro-gynecology beyond the common faradic battery is as great as the strides from the canal boat to the ocean greyhound; that in expert hands the dosage of electricity is safe in all currents and methods, and that many of the most valuable applications can be made by the general physician as well as by the specialist. He will clearly define the limitations of this agent in the cure of disease, and its useful services in the relief of incurable conditions, and he will state when to prefer the familiar methods of medical prescribing with the same exactness

with which he is able to set forth the contra-indications for electricity.

Contra-Indications.—Probably all who have read any treatise upon this subject are now aware of the well-known and chief contra-indications in gynecological electro-therapeutics. These may practically be grouped as malignant disease, fibro-cystic tumors of the uterus, fibroid tumors complicated by suppurating and grave lesions of the adnexa, and the presence of pus in the pelvis which should be evacuated.

The character also of other conditions which electricity will not benefit is well defined. Ovarian tumors belong to this class; so do about fifteen per cent of advanced fibroids which have deformed the uterine canal so that an electrode cannot be inserted; so do submucous and polypoid growths within the uterus and so do anatomical injuries which only the surgeon can repair, but in some of the above lesions we can abate pain and control some symptoms, and after operation do the patient much good with electricity.

The great field for electricity in gynecology lies between the conditions which are readily amenable to medical prescribing and the proper sphere of radical surgery. Covering the wide range of usefulness between these two extremes it occupies vastly more than the middle ground. It is the most important single agent known to medicine in this branch of work, and its usefulness is not restricted to cases in which everything else has failed, or in which its unaided action will produce a cure.

In some cases it answers every purpose alone. In other cases it will require the aid of other resources of medicine. In other cases it will co-operate efficiently with other remedies and especially with conservative or radical surgery, and lend ever a helping hand which affords comfort to the patient even though its direct action upon some diseases is a minor one.

Intra-Uterine Cauterization.—The popular understanding of the word cautery involves a searing and burning effect. It is essential to understand something entirely different in the

meaning of the word *cauterization* by medical galvanic currents. The term is not satisfactory to indicate the action which takes place, but I employ it because it is in general use, and will serve the purpose, if its modified meaning is made clear to the mind of the physician.

Through the teachings of Apostoli the world has become familiar with the fact that those who use his methods apply to the lining of the uterus a galvanic current with a bare metal electrode, and produce effects with certain doses of current strength which are called galvano-cauterization, while the effects of lesser and medium doses are referred to as galvano-caustic. The so-called *cauterizing application* is an *electrolytic action increased in rapidity by an increase in the rate of current flow.* It is an *intense* electrolysis of the tissues maintained for the short space of about three minutes, and is as different from the *searing* of the *actual cautery* as the proper cooking of a roast of beef is different from the burning of the same roast to a charred cinder. One furnishes nourishing food for the repair of the tissues, the other absolutely destroys.

The medical galvanic current is obtained from ordinary cells connected in one, two, three, order so that a gradual increase in voltage and milliamperes go hand in hand together, according to the number of cells employed in a given treatment, and proportioned to the resistance in the circuit. The factor of resistance modifies every application. The current which passes through the tissues between the two electrodes is always small, and the effects may properly be termed medical.

The cautery battery is not made up of from forty to sixty cells connected in *series*, but of one, two, or about four cells connected in *parallel*, and furnished with zincs and carbons of extra large size. The resulting current from this battery is well-nigh all *amperage*—from 10 to 100 times greater than any medical dosage acting *within tissues.* When concentrated at a point of resistance it is converted into heat and heats a platinum knife to a white heat or cherry red for cauterizing use only. The cautery current is never passed *through* tissues *be-*

tween two electrodes. Its effects may properly be called *surgical*, and they are *as foreign to the action of medical galvanic currents as these are employed therapeutically throughout the world, as would the action of a cutting knife in the hand of a masseur be foreign to massage.*

Taking up a volume of a large System of Gynecology I find the following remarks:

"Local treatment of diseases of the uterus should be employed for two objects, to remove the disease, to restore the organ to health and leave it uninjured in structure. The therapeutist is bound at once to reject all the more powerful and destructive agents. The nitric and chromic acids and other caustics are being laid aside, but only, I fear, to give place in some cases to new, but none the less destructive, agents. I allude to galvano-cautery and thermo-cautery. I most thoroughly appreciate their value in the treatment of malignant disease when the destruction of tissue is called for, but in the treatment of benign inflammation, chronic endometritis or hyperæmia of the mucous membrane of the cavity of the uterus they cannot fail to work a great and uncalled-for destruction."

The general practitioner who is reading up a case in a standard text-book may consider the point apparently made an important one. No cautery burning of the above character is practised by Apostoli or any of his rational followers.

When constant galvanic currents are applied to the endometrium with an electrode of comparatively large surface, many times larger than the searing cautery loop, and are driven into the tissues by the usual voltage which is required to develop 75, 100 or 150 mil. of current strength, there is not only a good deal of diffusion of the local polar action, but the electrode remains far below the temperature of the red-hot searing wire. The contrast between the two is so great that there is no other room than the play of the completely ignorant imagination to confound the two in practical electro-therapeutics.

To burn out the whole mucous membrane of the uterus with the hot, searing, destructive cautery for the cure of an inflam-

mation is not a conceivable act. Instruments are not used in such a way. The so-called cauterization for the cure of endometritis by medical galvanic currents is a reparative and not destructive process and restores the normal functions of the organ so that pregnancy has resulted in many cases. This fact alone is proof of the enormous difference between the good results obtained in practice, and the theoretical fears expressed.

CHAPTER XVI.

TREATMENT OF MENSTRUAL DERANGEMENTS.

Simple Amenorrhœa. External and internal methods of treatment with both galvanic and faradic currents. Amenorrhœa due to chronic degenerative changes. Clinical remarks. Amenorrhœa from deficient uterine development. Amenorrhœa following surgical operations. Diminished menstruation in plethoric women. Scanty and irregular menstruation. Menstrual apathy following shock, etc. Simple delayed menstruation. Remarks.

Simple Amenorrhœa.—Galvanic, faradic, and static currents, by both external and intra-pelvic applications, are available for the successful treatment of this condition, and either aid the action of essential constitutional remedies or unaided accomplish results which can be obtained by no other safe resource of therapeutics.

In the simplest form of Amenorrhœa in girls whose functions have delayed maturing; in chlorosis, spinal and pelvic anæmia; in depressing mental states, and in general when there are no evidences of a local pathological condition, when intra-vaginal examinations or methods are undesirable, and when medical judgment regards the encouragement of menstruation as indicated, we may supplement other hygienic and medicinal measures by external, nutritional and tonic applications to the spine.

For this purpose either of three currents is useful and the actions of all are exceedingly beneficial. As the static current may be employed without disrobing it may often be the first choice and its efficiency in simple cases leaves nothing to be desired.

The rule for insuring success in this class of cases associated with chlorosis, anæmia, and other states of general ill health

relates to applying mild static sparks as a local stimulant to an organ whose functions remain deficient after the general health has otherwise been restored. Improve the general health by exercise and tonics, remove the accumulations often present in the bowels by appropriate medication, and then a few static sparks will be sufficient to at once restore the previously deficient discharge. "It is for want of attending to this rule that so many cases have been said to have been unsuccessfully treated by static electricity." (*Bird.*)

Static.—Seat the patient upon the static platform and administer positive electrification for about eight minutes. Stop the machine, change the platform connection to the negative pole, and ground both the positive pole and the brass point electrode. Administer a tonic positive spray to the spine and over the lower abdomen for five minutes. In chlorotic, cachectic, and depraved states of health requiring prolonged constitutional upbuilding, this treatment may be repeated three times a week for a couple of months, in conjunction with any remedies that may be judiciously prescribed.

As soon as the patient will accept mild sparks to the spine and ovarian region they should be applied at the close of each *séance*. In cases not requiring sustained and regular treatment, and in the latter portion of the care of those who have received sufficient constitutional improvement, the static application may be limited to daily sittings three days before the expected flow.

Before the development of the high-tension induction coil, and the improved galvanic and faradic methods of Apostoli, the static spark was *facile princeps* in the realm of electrotherapeutics as a regulator of the menstrual function. It is as efficient to-day as it ever was, but it has been for the most part superseded by methods which are better in many cases, and yet it may be employed if desired in a large number of cases when only a local stimulation is required and when the exposure of the person for more direct treatment would be refused.

Percutaneous Galvanic.—In young girls, or in other cases in which external treatment only is deemed judicious, we may regulate personal hygiene and prescribe indicated remedies and in addition derive great help from percutaneous applications of tonic galvanism.

Place a felt-covered, flat electrode, 5 × 8, under the cervical spine or lumbar region, and a similar one over the lower abdomen. Make the spinal electrode positive and the other negative. Thoroughly saturate them both with the usual hot

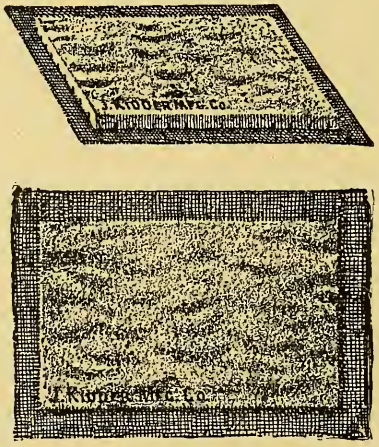


Fig. 36. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

solution of soda bicarbonate. Pass a constant galvanic current, gradually increased from zero up to 20 or 40 mil., according to tolerance of the skin, for 15 minutes. Reduce current to zero, switch the automatic rheotome into circuit adjusted to a rate of between two and three hundred interruptions per minute, and again increase the current until agreeable pulsations are felt through both electrodes. In about five minutes reduce current to zero and close the sitting. Dust the skin with toilet powder after removing the electrodes.

Repeat two or three times a week between menstrual periods for a couple of months. This application not only improves

the pelvic nutrition and circulation but also produces a beneficial effect upon the general nervous system. During the application of the *constant* current the situation of the spinal electrode may relate to either the upper or lower centres, and it is sometimes well to alternate the position at different sittings. During the application of the *interrupted* current the posterior electrode should always be placed beneath the lumbo-sacral region.

Spinal galvanization.—With the patient recumbent on a couch the galvanic current may be applied to the spine by

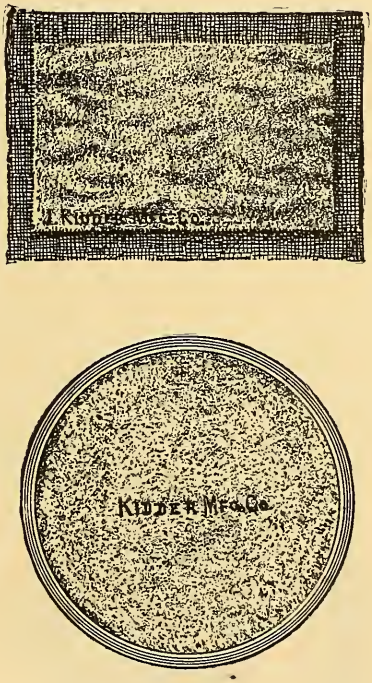


Fig. 37. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

exposing only so much of the upper and lower surface as will permit a felt-covered, flat electrode about 4×6 to be placed

at the back of the neck and a similar electrode upon the lumbo-sacral region.

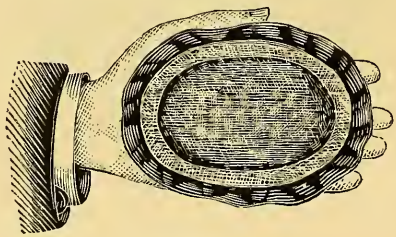
Connect the upper electrode with the positive pole and make the lower electrode negative. Gradually increase the constant galvanic current from zero up to about 20 mil., keeping within a comfortable tolerance, and maintain its action for about ten minutes. Repeat three times a week.

If the flow at the succeeding period is not free, persist until it becomes satisfactory, and thereafter apply the same treatment for two or three days just prior to the expected flow until several normal periods have been passed.

As treatment progresses the surface tolerance to the current will often increase and the dose may be somewhat increased accordingly, but as *the maximum of current strength in galvanic applications is always very gradually developed and the reduction to zero at the close of treatment is also gradual and should never be abrupt*, it is obvious that during a ten minute application we need consider only about one-half of this time as representing the maximum current activity.

After removing the electrodes dust the reddened skin with toilet powder and the patient is ready to dress.

Spinal faradization.—This faradic method requires the exposure of the entire spine with the patient reclining face downward upon a table or couch. Apply a sponge-covered positive electrode of medium size upon the nape of the neck and



POSITIVE.

Fig. 38. Sponge-covered flat electrode.

regulate a medium-coil, rapidly-interrupted current to a strength which causes an agreeable sensation and mild muscular con-

traction at all points of the spine when the negative electrode is promenaded up and down its entire length. An ordinary sponge-covered hand electrode lubricated with a little soap answers for this purpose. At each side of the spine the electrode may be passed a few times over the various motor points and also across the muscles of the lumbar region.

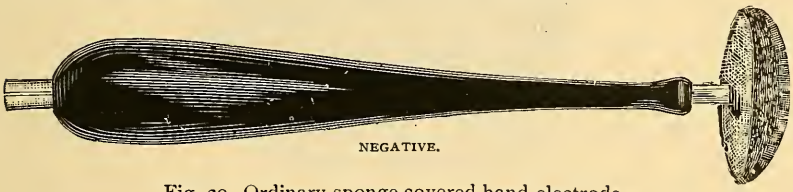


Fig. 39. Ordinary sponge-covered hand electrode.

Devote about ten minutes to the entire application, giving the greater portion of the stimulus to the muscles and blood-vessels of the lower spine. Dry briskly with a coarse towel and the patient is ready to dress.

These external methods closely resemble each other in principle of action and may be selected according to the convenience of the operator or his apparatus, although in certain cases the physician may discover therapeutic reasons for preferring one of the three currents. As regards indications, duration and frequency of treatment and clinical results there is not much choice between the methods. They are only suited to cases of the simplest form which require only a functional stimulation and which are not associated with actual uterine disease.

Internal local methods.—Vaginal.—*Faradic.*—In simple primary amenorrhœa, when internal local treatment is approved and desirable, a variety of methods are available. In virgins all possible injury to the introitus vaginæ is avoided by omitting the use of a speculum. The faradic current never requires the assistance of a speculum for the insertion of an electrode when it is employed (as it usually is) without invading the uterine cavity.

Apply an ordinary sponge, or felt-covered, positive electrode to the nape of the neck with patient on operating chair, with

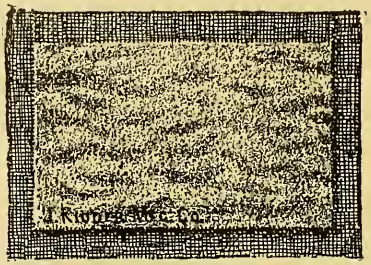


Fig. 40. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

limbs flexed and knees apart. Insert a mono-polar bare metal vaginal electrode and maintain it in position by gentle pressure during treatment. Connect it with the negative pole of the high-tension induction apparatus and regulate a rapidly-interrupted No. 36 or No. 32 long coil current, up to full tolerance, which will be governed by the varying sensitiveness of the

NEGATIVE.

Fig. 41. Vaginal electrode insulated transversely with hard rubber.

tissues, and differs in different patients and in the same patient at different times.

Continue the application from five to ten minutes.

If no pain has been present and full *stimulation* is indicated, shut off the maximum current *abruptly* at the close of the sitting.

If *sedation* is indicated by local sensitiveness, reduce the current to zero very gradually. The necessary smooth and even increase of current strength in regulating the dose must be secured with the aid of the rheostat.

Repeat three times a week until improved, and then once a week between periods, with two daily applications just previous to the expected flow.

The vaginal bipolar electrode may be used in some of these cases and possesses the advantage of greater facility, but is less effective in determining a circulatory stimulation through the larger blood-vesssls.

Intra-uterine.—*Galvanic.*—When the experienced physi-

Fig. 42. Fine felt or sponge-covered electrode—assorted sizes with soft rubber insulating backs.

cian is certain that an intra-uterine application is indicated, alterative and electrolytic actions require the galvanic current. The influence of the negative pole will render the canal patulous, stimulate the blood supply of the uterus and entire pelvic circulation, and set up the alterative and nutritional changes described in the chapter upon Electro-physiology.

Place a positive, felt-covered, flat electrode 4 × 8 on the cer-

NEGATIVE.

Fig. 43. Intra-uterine tips for negative pole.

vical spine with the patient in the dorsal position on the operating chair. Cleanse the parts sufficiently with either a vaginal douche or careful swabbing, and engage and expose the Os with a speculum. Sterilize and insert a negative intra-uterine electrode-sound of a size suited to the canal, and pass it gradually into the uterus under the action of five or seven mil. of constant galvanic current if the Os is not patulous and if the

electrode does not freely enter without the aid of the current. (See STENOSIS.)

When fully inserted gradually increase the dose through the rheostat to 15, and finally to 20 mil., holding the maximum amperage for about five minutes. Gradually reduce the current to zero. Entire *séance*, ten minutes.

If decided stimulation and muscular contraction of the uterus is indicated, switch the automatic rheotome into circuit after the constant current application is reduced to zero. Adjust

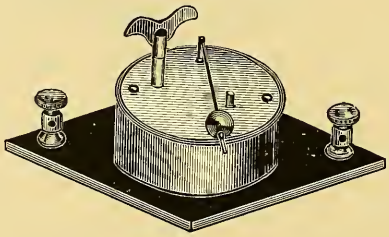


Fig. 44. One form of galvanic interrupter. Adjust rate by shifting the ball.

the rheotome to a slow rate of about 100 interruptions per minute and again raise the dose to a current strength which will set up painless but vigorous contractions. In three minutes reduce to zero and close the sitting.

Applications of this character may be made twice or three times a week, either regularly during the interval between two periods, or during only the week of the expected flow. Associated conditions will guide the judgment of the operator in the treatment of each case and the duration of treatment will be determined by the results

In Amenorrhœa existing as a symptom of anæmia or constitutional debility, or as a conservative process of nature in cachexias and exhausting diseases, do not employ intra-uterine electrodes. Improve nutrition in general and employ static or faradic stimulation to the spine, or percutaneous galvanism as directed in this chapter.

In Amenorrhœa associated with general plethora, local conges-

tion and the opposite of the anæmic state employ intra-uterine negative galvanism if no active inflammation is present.

Amenorrhœa due to chronic degenerative changes of the lining membrane of the uterus resulting in an atrophic state.

Galvanic.—Place a positive, felt-covered, flat electrode, 6 × 9, under the lumbo-sacral spine. Insert a negative intra-uterine electrode-sound to the fundus of the uterus with the usual antisepetic precautions. Gradually increase the constant galvanic current from zero up to 20 mil. at first, and as toler-

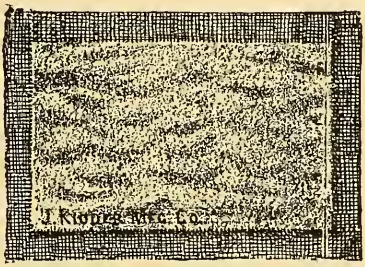


Fig. 45. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

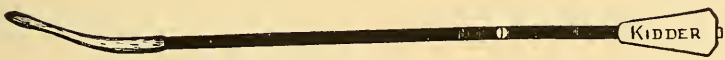


Fig. 46. Intra-uterine electrode.

ance increases carry the dosage in subsequent treatment up to 30, 40, or 50 mil. Always keep within comfortable tolerance and be alert to detect and avoid irritation.

Apply the maximum current for about five minutes and gradually reduce to zero. Total length of sitting, ten minutes. Repeat twice a week for several periods, until satisfactory results are established.

Clinical Remarks.—In the majority of women hygienic treatment combined with ferruginous tonics and saline laxatives will bring on the periods in from four to eight weeks. This treatment, which is very effective in anæmic patients, is

not so effective in married women who are very stout. Fortunately in their case we have a valuable means of developing the uterus and appendages by causing a greater flow towards them, and that is the high tension faradic current applied with the bipolar intra-uterine electrode. I have had a great many such cases, principally in sterile women who have been married three or four years, and who while having no periods are becoming stouter and stouter. After from four to twenty applications of bipolar faradization the menstruation has almost invariably been re-established, and afterwards the amount can be made to increase by continued applications of the faradic current. (*Smith.*)

Never begin the treatment of any case of disordered menstruation without first regulating the action of the bowels, or at least making an attempt to correct chronic constipation. Never make any vaginal bipolar faradic application with an accumulation of fæces in the rectum. Attention to simple details of this character is as indispensable to successful electro-therapeutic work as is the electrical apparatus itself.

Amenorrhœa from Deficient Uterine Development.—In these I have employed the long, fine secondary faradic current with the most satisfactory results, in some cases the flow becoming firmly established after two or three applications, although in the majority it required two or three applications a week for two or three months. In two or three cases in which amenorrhœa was due to an infantile state of the genital organs a longer time was required, but I am satisfied that the most pronounced case can have her uterus so powerfully stimulated by means of the uterine bipolar faradization that eventually it will attain a depth of two and one-half inches, and other conditions being favorable she will conceive and bear children. (*Smith.*)

Amenorrhœa Following Surgical Operations.—In these cases in which the function of the uterus is arrested, and particularly when atrophy appears to be in progress, the patient should be treated with intra-uterine bipolar faradic stimulation repeated three times a week until results are obtained.

Method.—In both the above cases the technique is the same. Carefully cleanse the cervical canal and the intra-uterine bipolar electrode. Connect the tip end to the positive pole and

the negative to the inner half. Insert it to the fundus of the uterus. Switch into circuit the rapid interrupter and four or five cells. Regulate the current from zero until it is comfortably

Fig. 47. Intra-uterine bipolar electrode. (Faradic.)

felt. In ten minutes reduce to zero and switch to the slow vibrator regulated to about 80 periods per minute. Again increase the current strength until strong, agreeable contractions are set up. In three or four minutes reduce to zero and remove the electrode. Repeat every second day.

Diminished Menstruation in plethoric women with tendency to adipose deposit and indications for restoration of free and full flow.

In these cases the selection and alternation of methods will easily be determined by experience with individual patients. If three treatments per week are given, two of them may advantageously be vaginal bipolar faradic stimulation, and the alternate method may be intra-uterine negative electrolysis with the positive electrode over the lumbar region ; or, in cases especially marked by abdominal adipose formation, the bipolar method should be omitted and percutaneous galvanism substituted instead. Place the negative electrode upon the lower abdomen, with the positive under the lumbo-sacral spine, and apply both constant and interrupted current in the usual manner.

The tendency of the treatment will be to re-establish free drainage and flow, improve the general nutrition and limit the increase of fat, and in some cases bring about a considerable reduction. Treatment may be continued until benefit ceases. Three or four months' time will usually be required to establish lasting results.

Scanty and Irregular Menstruation.—The *general con-*

dition of the patient being taken into account, and no inflammatory lesion contra-indicating the local application of an intra-uterine electrode, a mild negative galvanic current administered once a week, with vaginal bipolar faradization twice weekly, will aid to restore a healthy uterine state.

Menstrual Apathy following shock to the system, or miscarriage.

Galvanic.—Place a positive, felt-covered, flat electrode, 6×9, under the lumbo-sacral spine. Insert a negative electrode-sound to the fundus of the uterus. Increase the constant gal-

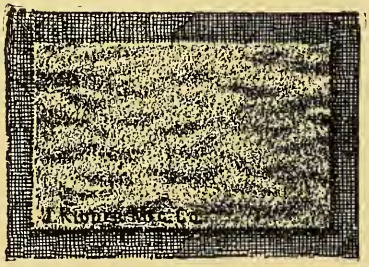


Fig. 48. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

NEGATIVE.

Fig. 49. Intra-uterine tips for negative pole.

vanic current through the rheostat from zero up to 20 mil., and maintain the maximum for five minutes. Gradually reduce to zero, switch the interrupter into circuit and again increase the current strength sufficiently to cause comfortable contractions. In three minutes more close the sitting. Repeat twice before each period, with two days between the

applications. Continue treatment until the normal function is established. Much assistance may be derived from the general tonic affects of static electrification administered regularly every day or every second day for a few weeks.

Simple Delayed Menstruation.—*Galvanic.*—Place a positive felt-covered, flat electrode, 6 × 9, on the lower abdomen, or under the cervical or lumbar spine, according to convenience or indications of the case. Pass a medium-sized, negative, intra-uterine electrode-sound to the fundus of the uterus. In-

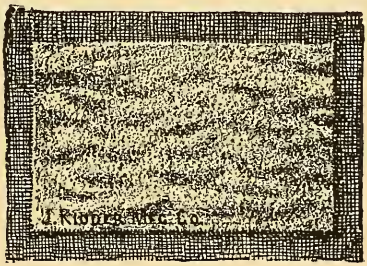


Fig. 50, Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs,

Fig. 51. Intra-uterine electrode—assorted size tips.

crease the constant galvanic current through the rheostat from zero up to 20 or 30 mil., according to tolerance. Maintain the maximum dose for five minutes and gradually reduce to zero. Total length of sitting ten minutes. Repeat two or three times if necessary with an interval of two days between each application.

Faradic.—Place a positive, felt-covered, flat electrode, 6 × 9, upon the lower abdomen. The vaginal electrode may be either mono-polar as shown in fig. below, or the usual bipolar elec-

NEGATIVE.

Fig. 52. Vaginal electrode insulated transversely with hard rubber.

trode may be used by connecting the tip alone with the negative pole. Connect the selected electrode with the negative pole of the high-tension induction coil, apparatus. Switch into circuit the 800 yard No. 32 wire coil, the rapid vibrator and four or five cells. Regulate the current strength to comfortable tolerance with one-fourth of the resistance of the primary rheostat remaining in. If the tissues are insensitive to the long No. 32 coil, switch to a shorter and coarser coil till sufficient effect is produced.

Quickly slide the contact piece of the primary rheostat so that it will cut out sufficient resistance to cause a powerful increase of the rapidly interrupted current and produce a wave-like contraction of the parts—which is immediately relaxed by at once shifting the rheostat to restore the previous resistance. Repeat this manœuvre at intervals of a few seconds for about five minutes. If skilfully done the powerful stimulation produced in this way will be in no degree painful or unpleasant. It possesses the advantages of being devoid of danger and of requiring no invasion of the uterine cavity.

Static.—In young girls during the period when menstruation is becoming established and requires some aid, in women approaching the menopause, and in other cases where but little more is needed than a stimulus to the circulatory and nervous forces, and when exposure for local applications is refused, the application of static sparks is often effective, and was at one

time the only means employed in electro-therapeutics for this purpose.

Stand the patient, fully clothed, upon the static platform connected with the negative pole. Ground the positive pole and the brass ball electrode. Apply strong, single, thick sparks upon the spine and over the lower abdomen with particular attention to the lumbar and ovarian regions. Do not apply the sparks too rapidly for the comfort of the patient, but continue them for about five minutes, with necessary intervals of relief.

In some cases the desired result is produced shortly, or within a day, and a single application once a month is satisfactory until no longer needed. It may be repeated daily for several days previous to the expected flow if such repetition proves to be necessary. It is a method free from all possibility of harm, but must, of course, give place to other methods whenever the sparks annoy a patient whose nervous tissues are in a hypersensitive state.

Remarks.—In all the foregoing directions it is understood that precautions against sepsis are to be observed, and that no intra-uterine treatment should ever be given unless proper indications exist. Nearly all the liabilities of harm from the manifold uses of electric currents in gynecology relate to intra-uterine interference. In a large number of cases this is not necessary, and prudence in approaching the necessity (when it exists) is advisable.

I am accustomed to sterilize bare metal electrode-sounds by dipping them in alcohol at the last moment and burning off the surface ; or they may be passed through the flame of an alcohol lamp. This method is very simple and seems sufficiently satisfactory.

All galvanic protected electrodes in these cases must be moistened in a solution of bicarbonate of soda and hot water, and pressed just dry enough to avoid dripping when *in situ*. Faradic external electrodes covered with felt or sponge may be moistened in plain warm water. With either current the

moistened electrode should be applied to the skin as hot as comfort will permit. After the electrode is removed the skin should be dried and dusted with toilet powder before the patient replaces her clothing.

It is needless to say to any physician who possesses more than a tyro's knowledge of the influence of galvanic and faradic currents upon local and general nutrition and upon nerve and muscle function that the methods above described will not only correct the amenorrhœa, but will produce happy and beneficial effects upon the pelvic structures in general, and often upon the general health. The relief of pain which may have accompanied the menstrual derangement will be among the marked advantages which the patient derives from electricity.

CHAPTER XVII.

TREATMENT OF MENSTRUAL DERANGEMENTS.

Menorrhagia. Passive hemorrhagic states of the uterus. Metallic-electrolysis in hemorrhage. Remarks on bleeding states of the uterus. A beginner's experience with post-partum hemorrhage. Fœtid menstruation and fœtid leucorrhœal discharges. Static electricity and menstruation in general. Cervical and lumbar backache of women. Gynecological wrecks. The menopause. Premature menopause. Puberty.

Menorrhagia.—In its simplest form this condition is corrected readily by tonic applications of electricity aided by medication directed to the anæmia, atony or other constitutional dyscrasia on which profuse periods may depend.

Percutaneous galvanism and vaginal bipolar faradization are the two extra-uterine methods of electrical application. The one selected as most appropriate for a given case should be applied three times a week between the periods, and the galvanic method may be employed with benefit, and without objection, during the actual flow, after it has continued a sufficient time and does not cease. Instructions for employing these methods are given elsewhere. (See INDEX.)

Hemorrhagic States of the Uterus.—When the bleeding is not active and does not demand operative interference.

Galvanic.—Place a felt-covered, negative electrode, 7×10, on the lower abdomen. Insert a positive platinum electrode-sound in the uterus so that it will make contact with the entire canal. If this is not possible (either from lack of such an electrode, or from the shape and size of the canal) a zinc-amalgam tip electrode may be employed and the surface treated in sections.

Gradually increase the constant galvanic current from zero up to full tolerance. Maintain the maximum current for five

minutes and reduce to zero. Repeat on the second day and until the oozing is controlled.

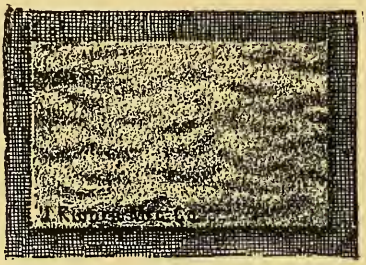


Fig. 53. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Fig. 54. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

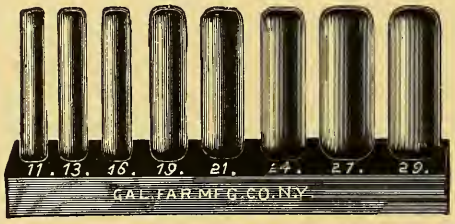


Fig. 55. Set of copper or zinc bulbs.

Handle for same.

At the first *séance* the amperage may reach full tolerance at only 40 or 50 mil., but as active chemical cauterization is required to control the bleeding vessels the dose must be pushed at each sitting until the effect is secured. From 80 to 100 mil. may be thus attained in a few sittings and will be effective in most cases.

If more current is required than the area of the external electrode will handle with comfort, place a similar pad under

the sacrum and connect both the external electrodes to the negative pole by a bifurcated cord.

The electrode must be held motionless during the application so that continuous contact between the metallic or carbon surface and the tissues is maintained until the bleeding vessels are thoroughly cauterized.

After the bleeding is apparently controlled the case should be treated once a week with a milder current until normal conditions are established.

This method involves only the cauterizing action of the positive galvanic current with a non-attackable electrode and high amperage. The alternate method utilizes the astringent and hemostatic properties of metallic electrolysis, and in uncomplicated uterine hemorrhage may be given preference. In many cases it is superior to the galvanic current alone, and requires much less amperage.

Metallic Electrolysis in Hemorrhage.—The external negative electrode is the same as above. The positive intra-uterine electrode must be selected from the set of copper tips or sounds according to the size of the canal. It should be as large as will readily enter.

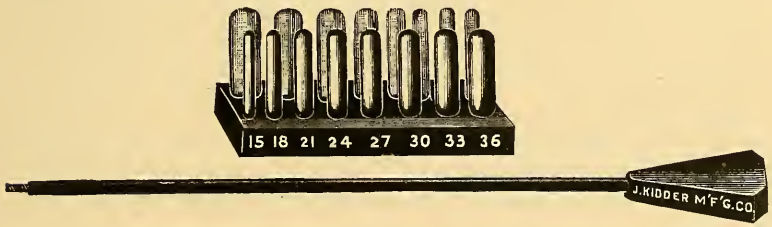


Fig. 56. Zinc and copper tips for metallic electrolysis.

Increase the constant current strength through the rheostat from zero up to 20 mil., and after two minutes increase to 30 mil. Maintain the maximum current for from five to ten minutes according to the intensity of action required. The largest electrode will have more current capacity than smaller sizes, and this must be taken into account in regulating the

dose. The longer the application the more oxychloride of copper will be deposited in the tissues, and an excess will cause colic a little later. Practice will teach the art of securing the desired effect without an excess of current.

Hold the electrode motionless during the application. It will become adherent to the tissues. Do not free it by force. Reduce the current to zero, reverse the polarity and pass a mild negative current of about 7 mil. until it loosens itself and slips readily out of the uterus.

The hemostatic action of cupric, zinc, or zinc-amalgam, electrolysis "will often control the bleeding when every other means has failed," but it is sometimes followed by a few colicky pains and occasionally by a primary aggravation of the hemorrhage, which is not an evidence of failure. It may be due to conditions which the treatment was too late to control, and may in part be due to the use of the negative pole in loosening the electrode. If permanent improvement is not observable at the first period it may be marked at the second, and the final result be perfectly satisfactory.

Before and after all intra-uterine applications in bleeding states the parts should be cleansed and a tampon of iodoform gauze placed around the cervix immediately after the withdrawal of the electrode.

Metallic electrolysis is antiseptic *per se* and involves no danger of sepsis.

The electrode, whether copper or zinc, must always be brightly polished with OO emery paper at the moment of inserting it in the uterus, and needs no sterilizing except upon the insulating handle which occupies the cervix.

Metallic electrolysis is a method which acts with few repetitions. It should be repeated only when the indications call for it, and only after the lapse of sufficient time to demonstrate the results of the first treatment.

Remarks.—For controlling obstinate and severe forms of uterine hemorrhage the coagulating and hemostatic action of the positive galvanic current is remarkably effective when

it can be properly applied. It does not take the place of the curette when clots and large portions of the placenta are retained after miscarriage, and if for any reason the lining of the uterine canal will not make free contact with the surface of the electrode the current will fail to cauterize the tissues and stop the bleeding unless the interference is removed.

In extreme hyperæsthetic states some partial anæsthesia will (in rare cases) be necessary to render rapid cauterization with a current of high intensity possible at the first sitting, when urgency and active bleeding demands it. A few occasional whiffs of chloroform as administered in obstetrics will answer the purpose.

Rest in bed, hygienic precautions and accessory medical treatment are to be considered by the attending physician according to the indications of each case. At all times the action of electricity should be supported by the best judgment of the practitioner and not simply left to chance for its effects.

It is obvious that some cases may be treated at the office, but that severe cases can only be treated in the house or hospital.

If bleeding persists after curettage for any of the conditions which demand it, the positive galvanic cauterization or metallic electrolysis will aid greatly to shorten the enforced rest in bed and hasten convalescence. When the patient is able to be about and continue treatment at the office, the full return of strength and health will be admirably promoted by static electrification and also by percutaneous galvanism or by the vaginal bipolar method.

Remarks on Bleeding States of the Uterus.—In profuse menstruation electricity finds perhaps its greatest usefulness. On this point at least I can speak from a considerable experience. A common cause of menorrhagia is fungous endometritis. In this disease the uterus is large and heavy and the circulation in it is bad. This may be due to faulty position, interference with the circulation, sub-involution after a miscarriage, or a septic confinement with or without a laceration of the cervix. In cases of menorrhagia from these causes I have

had most gratifying results with the continuous current, the positive pole in the uterus. We can be almost certain in every case that the uterus will return to its normal depth and size after from five to twenty applications.

By most writers fibroid tumors are considered among the principal causes of menorrhagia, but in my opinion they are merely a coincidence with the fungous endometritis, both being due to the same cause—obstructed circulation in the uterus. In hundreds of cases of profuse menstruation I have almost invariably seen the flow diminished merely by improving the pelvic circulation, and very often with no other treatment than the cure of the constipation.

Whatever may be the cause of the obstructed circulation the condition is generally the same. The close capillaries which supply the mucous membrane bleed profusely on the slightest injury. . . . . This is the condition of the mucous membrane which gives to the uterine myomata their most characteristic symptom of hemorrhage. It is not the tumor but rather the condition of fungous endometritis which so often accompanies it, as well as the increased area from which the hemorrhage takes place when the cavity of the uterus is thus enlarged, which are the real causes of the bleeding.

If now the spongy and exceedingly vascular endometrium be removed we shall have, instead of varicose veins which break and remain open, small arteries which immediately contract and close up when cut across or otherwise destroyed. The cleaning out of the uterus with a sharp curette has been found a useful temporary expedient for the arrest of hemorrhage, but to be effective at all it is most essential that the curetting be followed by a caustic which will close up the open ends of the blood-vessels.

The intra-uterine application of the positive pole of the continuous galvanic current of sufficient strength produces precisely this effect, and, moreover, the mere fact of passing a strong current through the electrode renders it aseptic and therefore perfectly safe. Moreover the interpolar action of the current exerts a powerful influence upon the trophic nerves which the sharp currette does not, and this is another advantage in favor of electricity.

In several cases of metrorrhagia due to suspected commencing cancer of the uterus, in women who have passed the menopause and begun to flow again, I have arrested the bleeding with positive galvanization so that it has not returned.

. . . . I only mention this case as one illustrating the almost infallible power of the positive galvanic current to arrest the severest forms of hemorrhage.

As for cases of menorrhagia due to chronic endometritis, with or without fibroids, I have never known it to absolutely fail; and even one case which I reported some time ago as a failure called to see me the other day to say that the frightful hemorrhages had never returned, that she had gained in flesh and weight and felt altogether so well that she had ventured to get married. Even in her case—one of fibroid—in which I was prevented from using full doses on account of the tenderness of the appendages, the latter had been so much benefited that menstruation is now almost entirely free from pain.

But as I have already said there are so many cases reported of menorrhagia having been cured by intra-uterine galvanic treatment that they alone would fill many volumes. That this treatment will cure menorrhagia almost with certainty is one of the best established facts in therapeutics. (*Smith.*)

The following account of a triumph over uterine hemorrhage is told with a directness which will convey a practical lesson to the general practitioner:

When a mere lad my preceptor sent me to attend a charity obstetrical case. My knowledge of the anatomy of the female pelvis was of the most rudimentary character, as was also my knowledge of the obstetric art. Fortunately the baby was soon born, and I immediately became concerned about the delivery of the placenta. While groping around in the dark with my fingers I chanced upon a labia minoria which was hypertrophied after the fashion of the Hottentot. I forthwith began to pull upon the labia thinking it was the placenta. Simultaneously the woman commenced to shriek. With the calm dignity I had seen my preceptor exhibit toward nervous females, I remarked, "Be quiet, my good woman, I am only delivering the afterbirth." "Afterbirth? you fool," she yelled, in utter disregard of the rules of grammar, "it's me you are pulling on." A strong after-pain came to my relief at this moment and the placenta was expelled, but with it came a stream of blood the equal of which I have never seen since in a practice of fourteen years.

I had read about *post-partum* hemorrhage and knew the routine treatment. I kneaded the womb with the left hand and turned out the clot with the right, injected hot water and vinegar, and poured ice water on the abdomen from a height, but all to no purpose. The uterus would contract until no larger than a cocoanut, then relax, accompanied with a gush of blood that was truly terrific.

My patient was growing cold and pulse weakening, and I saw that unless reinforcements arrived the battle was lost. I hastily sent for my preceptor, and while impatiently waiting for his arrival I fully appreciated the heartrending agony of Wellington's "Would that Blucher would come!" Luck was with me that day, as it was with Wellington, for my Blucher, in the person of my preceptor, soon arrived, armed with per-chloride of iron and an overdose of contempt for his student who could not control an ordinary case of *post-partum* bleeding; but he soon discovered that this was no ordinary case, and he applied his styptics in vain. The uterus refused to contract and there was complete inertia.

Finally, a happy thought, we sent to the office for a faradic battery, applied one pole to the uterus and the other over the abdomen, turned on the full current, and, presto!—the inertia was a thing of the past, the uterus contracted to the size of an orange and stayed there, the hemorrhage ceased, and my Waterloo ended in a victory.

Several years ago I received an urgent message to attend a lady who was "flooding to death." Upon my arrival I found my patient pale and almost fainting from loss of blood. She was aged forty-five and passing the climateric; was the mother of eight children, and had had three miscarriages in the past two years. The uterus measured five inches. I prescribed the indicated remedy and douches of hot water and vinegar. Called again in four hours and found the patient no better. I then packed the vagina thoroughly; this controlled the hemorrhage, but it would recur whenever the packing was removed. Recalling my first obstetrical case I used my faradic battery as strong as the patient could stand it. The hemorrhage stopped at once and the woman has not menstruated but a few times since, and each time normally.

I attended a lady recently in her fourth confinement. I had attended her in her previous confinements and she had always flooded considerably, so I went armed this time with the battery, and it is well I did, for following delivery of placenta she had veritable *post-partum* hemorrhage. I immediately applied the battery, without other treatment, the uterus promptly contracted, and the hemorrhage ceased. After waiting a short time and the hemorrhage not recurring I went home to dinner. In the course of an hour a messenger came for me stating the patient was suffering great pain. I hastily returned and found the woman apparently again in the throes of labor. After several severe pains she expelled a round solid clot of blood the size of a cocoanut. The uterus had contracted instantane-

ously on application of the electricity and the blood had not had time to escape.

I have now a patient under treatment for large interstitial uterine fibroid. I used galvanism for several months three times a week, giving from fifty to seventy-five milliamperes at each treatment, but it failed completely to stop the hemorrhage. I then tried faradism and found to my surprise that it moderated the hemorrhage to a marked degree. This patient bought herself a faradic battery and uses it as soon as menstruation begins, and while formerly she flowed for ten weeks, since using the battery she never flows more than four days, and only moderately at that.

I could recite many more cases of the same character, but these are sufficient to show that faradism is a remedy we cannot afford to overlook in uterine hemorrhage. (*Daily.*)

The faradic current is indicated in all hemorrhages from the uterus due to relaxation of muscular fibre, in the hemorrhages attendant on subinvolution, in *post-partum* hemorrhages, and to some extent in hemorrhages of fibroids.

One of the simplest and most commonplace illustrations of the usefulness of the galvanic current in office practice in cases of metrorrhagia is the following:

Mrs. ——, aged 35, probably aborted two months previously, although she denied it. Has been unwell ever since.

Treatment.—A cleansing vaginal douche. Negative felt-covered, flat electrode, 7 × 10, on abdomen. Positive intra-

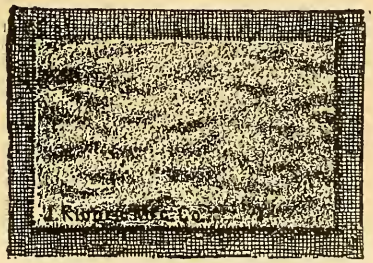


Fig. 57. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Fig. 58. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

uterine platinum-sound electrode. Thirty mil. constant galvanic current for ten minutes. Three days later repeated with 50 mil.

Report from first application : " Flow has been reduced to a mere show. My pain has been much easier and in every way I feel a great deal better.

The second application stopped the remainder of the flow.

Fœtid Menstruation and Fœtid Leucorrhœal Discharges.—*Galvanic.*—Perhaps the best aid electricity affords to supplement other local and constitutional measures consists of zinc-amalgam electrolysis.

Place a felt-covered, flat electrode, 7 × 10, on the lower abdomen and connect it with the negative pole. Freshly amalgamate an intra-uterine zinc electrode-sound, adapted to the size of the cavity, and insert it to the fundus of the uterus. Gradually increase the constant galvanic current from zero up to full tolerance, which will vary from thirty to sixty milliamperes. Begin with the smaller dosage in early sittings

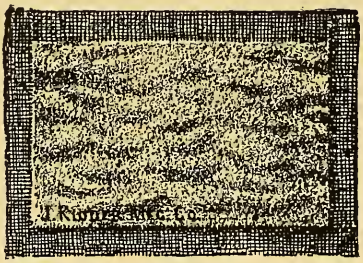


Fig. 59. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

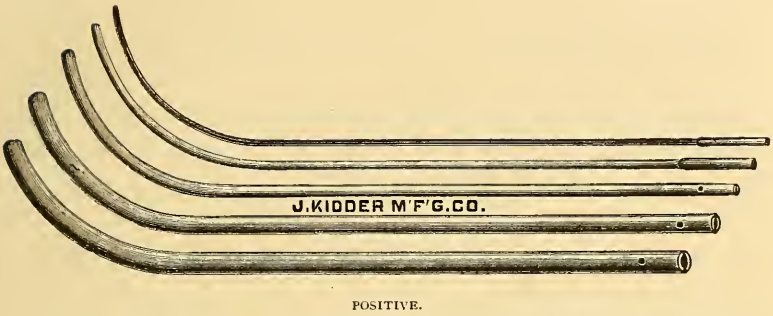


Fig. 60. Five electrodes: insulated with soft rubber tubing to expose any desired surface.

and increase the current as the tolerance of the tissues develops during the progress of improvement.

Duration of sitting from five to ten minutes, repeated twice a week.

If the condition returns after a few applications of this antiseptic current the cause of failure should carefully be sought and treatment modified accordingly.

Static Electricity and Menstruation in General.—When patients are undergoing a course of treatment by static electricity for some chronic affection, perhaps entirely disassociated from any pelvic cause, they may ask if treatment should be stopped during menstruation. Static sparks are usually not well borne at such a time, and practised operators make it a rule to omit them; but as the mild head breeze and simple electrification are not only peculiarly grateful to menstruating women, but afford relief to much of the irritability or even dysmenorrhœa which arises chiefly from ill health, it is beneficial and desirable to continue modified treatment during the period.

As no disrobing or exposure of the patient is required in static electrification, questions of delicacy do not enter into the consideration of the case.

Cervical and Lumbar Backaches of Women.—If there is in the whole range of medicine an unfailing balm to the

woman whose back feels as if it would "break in two," it is the electrical current generated by the Holtz apparatus.

Whether the ache is high up or low down, is mild or severe, is recent or old, is superficial or deep, is sore and tender to touch so that she can hardly wear her clothes, or is of the opposite character, I want no other remedy than electricity in somé form.

The first, simplest, and unfailing remedy for recent pains of congestion or fatigue is the static breeze. To older and more obstinate cases add the mild spark or counter-irritation.

There are few women who do not have backaches at some time. There are still fewer women who cannot obtain prompt and efficacious relief from selected forms of electrical applications. If the breeze and spark fail to do well in an inveterate and deep-seated case there it still left among the resources of the static machine the rapidly interrupted high-potential small Leyden-jar current which will handle the remainder of the cases.

Gynecological Wrecks.—Some years ago women encountered a panacea for the cure of their infirmities of whatever sort, from neuralgia to epilepsy. The result has put into our hands an army of women without ovaries, but with a nervous system with an unimpaired capacity for getting sick and feeling miserable. The reflex symptoms of disturbance are often about as great as they had been before the cause (?) was removed.

It is a thankless task, well-nigh beyond the powers of safe remedies, to follow these neurotic symptoms and give satisfactory relief. Drugs which are cruelly deceptive in their palliation of neuroses are too often injurious in ultimate effects to be long continued. Between bipolar faradization and static electricity relief can be afforded to patients of this kind who would otherwise drift hopelessly along in a pitiful and despondding state.

The Menopause.—To one who has never personally witnessed the benefits bestowed upon women during the neurotic

disturbances of the menopause the verbal recital of the action of static electricity upon this state would seem like gross exaggeration. It is a "state of disordered function," and every physician should carefully read the physiological action of static electricity upon functional derangements of the system. There will then be no occasion to charge any one with extravagance in reporting his clinical experience.

The general depression of the system caused by an attempt to subdue the neuroses of the menopause by the prolonged administration of bromides is an opprobrium upon scientific medicine, and the attempt to select remedies upon symptomatic indications often keeps both the physician and patient busy.

In many cases, however, the unfortunate woman either thinks that nothing can be done for her relief (and she accordingly endures her condition with what fortitude she can), or else her doctor prescribes a palliative and advises her that time alone will bring her permanent relief.

The fact should certainly be known to every member of the medical profession that this class of cases is distinctly within the chief sphere of action of sedative-tonic and function-regulating static electricity.

It is at this time of life again that mild static sparks around the pelvis have an effectual influence in regulating the declining menstrual function, just as they effectively regulated the commencing activity in puberty.

To recite the other capabilities of the different forms of application would be to narrate in detail every nervous, muscular, and functional disturbance of this period of a woman's life; for static electricity will relieve them all, will direct into normal channels of action the unsettled activities of sympathetic and cerebro-spinal nerves, and conduct the woman through and out of the season of the climacteric in a rational and satisfactory way.

To the operator who understands the management of his apparatus, the Holtz machine dispenses at once with many

other agents of the materia medica for the functional derangements of this stage of life, and not only surpasses them singly but collectively in value.

Even for the troublesome menopause, for which the laparotomist can offer no relief, the conservative gynecologist has in the fine wire induction coil current applied to the uterus or even to the vagina with the bipolar electrode a most effective means of drawing the attention of the nervous system back to the pelvis and away from the brain. Bipolar intra-uterine faradization with a medium coil causes a flow of nervous energy and sometimes of blood which makes a very fair substitute for the menstrual flow. (*Smith.*)

The chief applications of faradic and galvanic currents in this condition are two, viz., bipolar faradization and negative intra-uterine galvanic determination of blood to the uterus. The general methods of faradization are displaced by the simpler and more beneficial static applications.

In the absence of other indications the technique of these methods follows the directions for amenorrhœa, and therefore need not be repeated in full.

Premature Menopause.—In some cases the function can be restored by intra-uterine negative galvanism and tonic applications of coil currents as already described in the treatment of amenorrhœa. Whenever it is necessary to divert the nervous energy from the head to the pelvis the attempt should be made by these methods.

Puberty.—It is self-evident to any one familiar with the physiological action of static electricity that when either girls or boys are maturing with tedious delay, and especially when they have just suffered from some prostrating acute illness and convalesce slowly, scarcely any other agent would do them an equal amount of good. We need not dwell on this point. It is simply a question of suiting the method to any given patient's needs.

CHAPTER XVIII.

TREATMENT OF DYSMENORRHŒA.

Dysmenorrhœa due to endometritis. Dysmenorrhœa in young girls. So-called neuralgic, congestive, and ovarian types. Dysmenorrhœa complicated with uterine disease Membranous dysmenorrhœa with profuse or scanty flow. Dysmenorrhœa with stenosis of the canal. Dysmenorrhœa with incomplete development of the uterus. Percutaneous galvanism in simple forms of dysmenorrhœa. Dysmenorrhœa due to inflamed ovaries and inflammation of the tubes. A discussion on dysmenorrhoea. Various methods of treatment.

Dysmenorrhœa.—In many cases of dysmenorrhea there is a hyperæsthesia of the endometrium in the region of the internal Os and in the fundus. The touch of a sound will cause a sharp pain, and similarly uterine contractions cause spasmodic dysmenorrhœa.

The intra-uterine electrode application benumbs, alters, and restores to healthy nutrition the congested and irritable mucous membrane. The hyperæsthesia is removed, the vicious reflex contractions stop, and menstruation occurs thereafter without pain. "I have been," says Dr. A. L. Smith, "very much struck with this factor of spasm at the internal Os in my cases of fibroid tumor who came to me with their menstruation causing them the most fearful pain although there was no stenosis of the canal; and yet after from ten to thirty applications of the galvanic current, generally the positive pole in the uterus, menstruation would come on absolutely without pain. Moreover, notwithstanding that strong currents employed to diminish fibroids have contracted in some cases the cervical canal to the point of actual stenosis, nevertheless menstruation came on absolutely without pain and several of these patients even became pregnant."

For the treatment of endometritis and dysmenorrhœa there

is probably no better method or means than the intra-uterine application of the galvanic current. Endometritis is present in the majority of cases of dysmenorrhœa, and as a thousand or more skilled witnesses can be found in different parts of the world to testify from their own experience that intra-uterine galvanic treatment cures endometritis, it becomes easy to explain the otherwise "almost miraculous results" of this treatment in dysmenorrhœa.

Both the positive and negative pole have their clearly defined indications which are made familiar to the readers of these chapters. The positive galvanic current is almost an infallible remedy for dysmenorrhœa due to endometritis, while the negative pole is an equally valuable remedy to promote drainage and to remove the mechanical obstruction of a stenosis. Those who employ proper electrical currents in the treatment of these conditions rarely feel the need of other procedures, and the routine of topical application becomes for the most part a historical reminiscence.

Symptomatic. — When the cause of this symptom is uterine, *i. e.* an unhealthy uterus in any state which makes the passage of the ovum difficult and impairs drainage—stenosis of the canal, displacements, all the gradations of metritis and endometritis between congestion and an inflamed, hypertrophied and hyperæsthetic condition, a fibroid tumor, or whatever causes obstruction and produces endometritis, these manifold dysmenorrhœas can generally be relieved by dilatation of the cervical canal and treatment of the endometritis by proper electrical methods, and a large percentage of symptomatic cures obtained.

The negative galvanic current will always accomplish adequate dilatation except in the few cases in which the tortuosities of the canal, by a deforming tumor, prevent the insertion of an electrode, but the treatment of endometritis must follow an intelligent diagnosis of the condition present.

By this is meant that endometritis *per se* cannot be treated by *routine electricity*, but that the selection of the positive or

negative galvanic pole and dosage, and the auxiliary use of bipolar faradization must be made by the operator according to quite clearly defined indications laid down in the teachings of electro-physiology. Guided by these teachings *the choice of pole is rarely in doubt.*

To avoid repetition, the treatment of dysmenorrhœa dependent on endometritis is partly reserved for the section devoted to that subject.

Dysmenorrhœa in its simplest form in young girls, or chlorotic, neurotic, or any other cases, when local examination and treatment is undesirable or refused, and when the cause is not intra-uterine disease, may often be relieved during the acute pains, and curatively treated between periods, by one of two very valuable methods which involve no objectionable exposure. These methods are *percutaneous galvanism* and *vaginal bipolar faradization* applied according to the directions fully given under their separate heads.

The usual classification of the varieties of dysmenorrhœa possesses very little practical value to the electro-therapeutist, and to a great extent the theoretical discussion and routine treatment of works upon gynecology which ignore electric currents must now be deemed as *far in the rear of gynecological progress.*

Electricity is the sheet-anchor of conservative gynecology. If the case is a simple one the general health of the patient and the character of the flow will refer the physician to the proper treatment for either deficient or excessive menses, and separate treatment for the pain will rarely be required when either external or vaginal applications are indicated. The pain will be controlled when the condition which causes the pain is relieved by the electrical administrations.

The bipolar method may be practically useful, either alone or as an adjunct to intra-uterine galvanism, in almost all cases of dysmenorrhœa which any non-surgical treatment will relieve or cure. It possesses no alterative electrolytic action upon a diseased mucous membrane, and therefore yields to galvanism

in chronic dysmenorrhœas due to an unhealthy uterine state, stenosis of the canal, and obstructive conditions which impair drainage and demand the chemical current. These latter conditions are probably of far less importance than endometritis as a cause of dysmenorrhœa.

Dysmenorrhœa of So-called Neuralgic, Congestive and Ovarian Types.—The main relief for these forms of dysmenorrhœa is afforded by *vaginal bipolar faradic sedation* as described

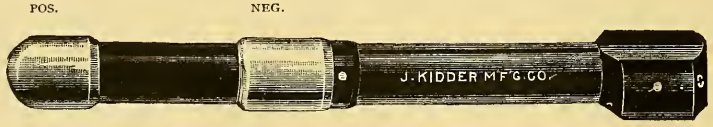


Fig. 61. Bi-polar Vaginal Electrode.

under that heading. It should be persistently and regularly applied at least three times a week between periods, and it should also be observed whether or not the uterine canal is patulous. Free drainage should be established by the negative galvanic current (see STENOSIS), and we may then rely with confidence upon faradic sedation with a properly selected current.

In no branch of therapeutic work does the improved high-efficiency induction coil apparatus present a greater contrast to the crude family battery than in the remarkable comfort, relief and almost invariable cure of these pelvic neuralgias and pains which so often formerly laid the foundation of the morphine habit or addiction to alcoholic stimulants. The uses of anodynes in gynecology may be immensely lessened by the substitution of curative bipolar faradic sedation for the pain-obtunders which only palliate the pain and tend to destroy health.

Complicated Dysmenorrhœa, associated with intra-uterine neoplasms, pelvic deposits, flexions, malignant disease, and causes demanding treatment in chief, must be considered with reference to the complications. The aid that electrical currents can render to treat the condition and to relieve the pain is stated under each separate heading.

In many cases when the pathological lesion cannot be radically cured the pain can be promptly relieved and often a symptomatic cure can be effected by electricity in cases which are otherwise hopeless. In cases which properly call for operative interference electricity well deserves to be regarded as the handmaid of the surgeon—the indispensable instrument of conservative precautions and post-operative aid to convalescents.

So-called "Membranous" Dysmenorrhœa (Profuse flow).—*Galvanic.*—As soon as menstruation ceases for a given period attack the diseased lining of the uterus with the galvanic current. Should the cervical canal not be already patulous it must be dilated moderately with the usual negative current of ten to fifteen mil. (see STENOSIS).

When this has been done apply a positive galvanic current to the entire uterine membrane from the internal Os to the fundus. The uterine electrode must be either platinum, or block tin, or carbon; or in some cases zinc-amalgam may be used, but platinum is usually employed.

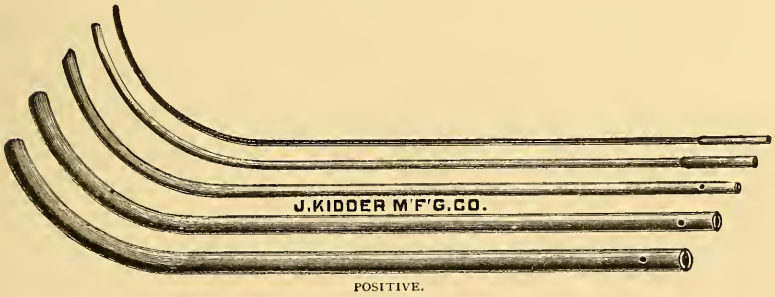


Fig. 62. Zinc electrodes: insulated with soft rubber tubing to expose any desired surface.

Fig. 63. Positive electrode with sliding shuttle.

Take two felt-covered, 6×9, flat electrodes, moistened thoroughly in hot soda-bicarbonate solution, and place one upon the lower abdomen and the other under the sacrum. Attach

them to the negative pole by a bifurcated cord. The large area of contact thus secured will permit the use of large currents without discomfort.

Insert an intra-uterine electrode of sufficient size to affect, with its metallic portion, the entire uterine lining. Increase the constant current through a rheostat from zero up to comfortable tolerance at the first sitting, and, after maintaining the maximum for about five minutes, reduce to zero. As the tolerance will increase after each application the dose may be gradually pushed from 50 up to 100 mil. in the course of six or eight treatments. Repeat only once a week between periods. Inter-current bipolar sedation will be useful also. If pain results from the galvanic application at any time, the sitting may be closed with a few moments *bipolar sedation*, and if conditions permit regular bipolar tonic applications two or three times a week the patient will derive great benefit.

Duration of treatment may extend over three or four periods, or until sufficient relief is afforded.

Membranous Dysmenorrhœa (*Scanty flow*).—For these cases in which after excruciating pain an entire cast of the uterine cavity is expelled the negative pole of the continuous galvanic current in the uterus has been found to be of the greatest benefit. The sittings should begin the week before the expected period and should be repeated every day or two, each sitting lasting ten minutes and a current strength of from 50 to 100 mil. being employed. Rapid dilatation and curetting performed under the most rigorous aseptic conditions have long been advocated for the treatment of this painful affection, but the negative galvanic current does the same thing in a much more gentle way, requiring neither anæsthesia nor subsequent confinement to bed. (*Smith.*)

Dysmenorrhœa of the form commonly due to *congestion*, recent *endometritis*, or some *hypersensitive*, *unhealthy state* of the lining membrane of the uterus. *Always* begin with vaginal bipolar faradic sedation and continue it alone until local tenderness is removed and a sound may be inserted without distress. The next step of treatment employs the constant current.

Galvanic.—After a careful diagnosis of the condition and the exclusion of contra-indications, cleanse the vagina with the usual creolin douche and place on the lower abdomen a felt-covered, flat electrode, 6×10. Sterilize the uterine-sound

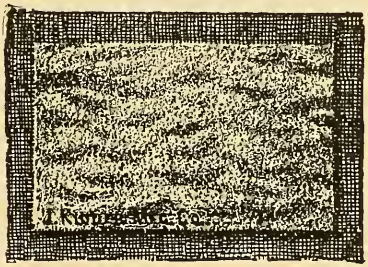


Fig. 64. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Fig. 65. Long tin tip intra-uterine electrode.

electrode adapted to size of the canal. If the uterus is large, soft, and the menstrual flow has been profuse, the sound electrode should be connected with the positive galvanic pole. If the uterus is hard and the flow scanty or delayed make the sound negative.

Increase the continuous galvanic current through a rheostat from zero up to 20 mil. Maintain this strength for a moment and gradually increase to the point of comfortable tolerance, but rarely exceed 50 mil. in any case, for high intensities and cauterizing effects are not required in this condition. The current action is called *galvano-caustic* by some writers.

About three minutes of maximum current action is sufficient. Reduce the current gradually to zero. Total length of sitting ten minutes. Insert a glycerine tampon if indicated.

No rules as to rest in bed or restriction of habits are usually enforced during the progress of treatment by this method. A half-hour's rest immediately after the application of every

intra-uterine galvanic current of over 40 mil. is desirable, but each patient is a law unto herself in this respect.

If the intra-uterine electrode is positive it must be non-

Fig. 66. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

attackable (usually pure tin or platinum), a fact the operator should never forget.

Repeat galvanic applications twice a week between several periods, each one of which will be more comfortable than the preceding if the method is properly carried out.

Inter-current vaginal bipolar sedative-tonic applications may advantageously be given, and when general tenderness exists should always *precede* the intra-uterine galvanism. So certain and unfailing are these combined methods in skilful hands that other procedures are seldom required, but the practitioner who is but little trained in electro-gynecology should advance with caution into the delicate regions of intra-uterine applications and the novice should never attempt them. Least of all should they be attempted without improved apparatus of the best type. Try percutaneous and extra-uterine methods first, even though they are less effective.

Dysmenorrhœa with "Stenosis of the Internal Os."—

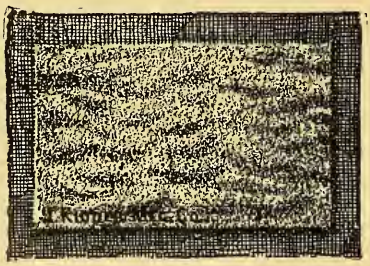


Fig. 67. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Fig. 68. Intra-uterine electrodes, assorted sizes.

Handle for same.

Galvanic.—Positive, felt-covered, flat electrode, 6×9, on lower abdomen; negative intra-uterine sound. After sterilizing the canal and the sound as usual, insert the electrode as far as it will go, and increase the constant galvanic current from zero up to five or seven mil. Exert very gentle pressure. Simply support the electrode so that the tip rests against the constricted Os. In a moment or two sufficient dilatation will often take place to carry the electrode into the uterus. If this does not occur increase the current strength gradually up to 10 mil., or sufficient to produce the desired effect.

When the electrode has entered the uterus to the fundus, increase the current to 20 mil. In five minutes reduce the current slowly to zero, withdraw the electrode and close the sitting. In subsequent applications the current strength may be gradually increased from 20 up to about 40 mil., always, however, keeping within the point of intra-uterine tolerance.

A glycerine tampon may be inserted after treatment if support and depletion is indicated, or if local tenderness exists a short *séance* of vaginal bipolar sedation should always follow. Bipolar and galvanic applications may be alternated three times a week between the periods if the case requires regular and systematic treatment. The patient is not required to rest in bed after treatment or make any change in her daily habits. Relief is usually prompt and satisfactory unless other complications retard results. In dilating the stenosis a gradual

increase in the size of the electrode employed will increase the diameter of the canal until drainage is adequate. Stenosis is probably not a very decided factor in the causation of dysmenorrhœa.

Dysmenorrhœa with Incomplete Development of the Uterus.—*Faradic.*—Place a felt-covered, flat electrode, 6×9, on

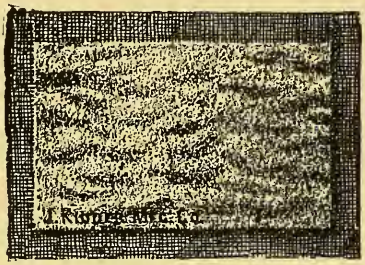


Fig. 69. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

the lower abdomen and connect it with the positive pole of a high potential induction coil apparatus. Prepare vagina with antiseptic douche, sterilize and insert an intra-uterine electrode sound to the fundus and connect it with the negative pole.

NEGATIVE.

Fig. 70. Intra-uterine tips for negative pole.

Switch into circuit four or five cells and the rapid vibrator. Support the electrode so that no unpleasant pressure is felt by the patient. The dose of current desired is that which will produce vigorous nutritional exercise of the muscular fibres of the uterus and adjacent tissues, without subsequent fatigue or pain, and it must be ascertained by tentative trial in each case.

Begin with the longest high potential coil and increase the current strength from zero until the desired dose is reached, no matter what coil is finally found to be required for the proper

effect. When the internal electrode is felt by the patient to grasp the tissues with a firm but comfortable contraction, produce regular and strong momentary impulses of the current beyond this strength by a rapid movement of the primary rheostat so as to cut out sufficient resistance to carry the dose to extreme tolerance and immediately return the resistance and relax the contraction. These wave-like and strong impulses may be repeated fifteen or twenty times a minute. Total length of sitting ten minutes, repeated three times a week between periods. The external electrode may alternately be placed over the lower abdomen and under the sacrum.

The use of the slow vibrator is generally advised to produce muscular contraction, but the contractions of the widely diffused, painless, and efficient method described above are sometimes superior to other plans of treatment. With an improved apparatus in which all gradations of E. M. F. and different coils are at command through the simple and instantaneous movement of a switch, the regulation of dose is independent of former directions as to the choice of fine or coarse coils and the perplexities of making a selection are cleared away. The author's rheostat in the secondary circuit not only controls the regulation of the current to suit each case, but obviates the shocks which were attendant upon switch changes in older types of apparatus, in which the E. M. F. was controlled only in the primary circuit.

In cases with scant menstruation the intra-uterine bipolar electrode may be preferably employed.

Fig. 71. Intra-uterine bipolar electrode. (Faradic.)

Percutaneous Galvanism in Dysmenorrhœa.—The relief afforded by the soothing galvanic current passed through the pelvic tissues at the time of pain is very different from the

effects of narcotics, anodynes, and the much advertised utero-sedative drug preparations. Galvanic sedation is also tonic and nutritional and imparts a general sense of well-being to the patient. I have seen it remove the pain in very severe paroxysms when anodynes merely stupefied the patient's sense of pain for a short time with depressing and disagreeable effects.

If the dysmenorrhoea is complicated by displacement and by chronic lesions, the relief afforded by percutaneous galvanism will be only temporary, although satisfactory in kind. Curative treatment with electricity during the inter-menstrual periods will be required to lessen the need of administrations for the relief of pain, and as few patients are so situated that repetitions of the percutaneous application would be convenient (if severe suffering during a period rendered them necessary), the resort to drug palliatives obtains preference in practice.

The influence of the continuous galvanic current upon the nutrition of tissues and upon functional processes is illustrated by many cases treated successfully with percutaneous applications alone. Williams cites the following:

Miss C——, aged 26. Menses regular and normal until the age of 21. At that time during a menstrual period she was out boating and capsized. The cold bath and shock stopped the flow. The menses became afterwards irregular, intensely painful and accompanied by mental disturbances. She was seen by me for the first time one year ago. Ordinary treatment had resulted in absolutely no benefit. Examination revealed a highly inflamed cervix, very sensitive and bleeding at the slightest touch. Vagina also very sensitive. For two hours before flow appeared and until two to four hours thereafter she suffered intense uterine and head pains with almost mania. Opiates had been administered for two years.

Requesting to be called at the time of next period I found her suffering as usual, and applied a negative electrode over the second lumbar vertebræ with a positive electrode over the anterior region of the uterus. A mild constant galvanic current was passed through the tissues for twenty minutes. At the end of that time she was asleep and slept for six hours, awaking with comparatively little pain. After the cessation of the flow I repeated the same treatment twice a week until the next period, which came on in four weeks. At this period the pain was

not so great, but I proceeded as upon the former occasion. With this treatment alone for three months the patient was

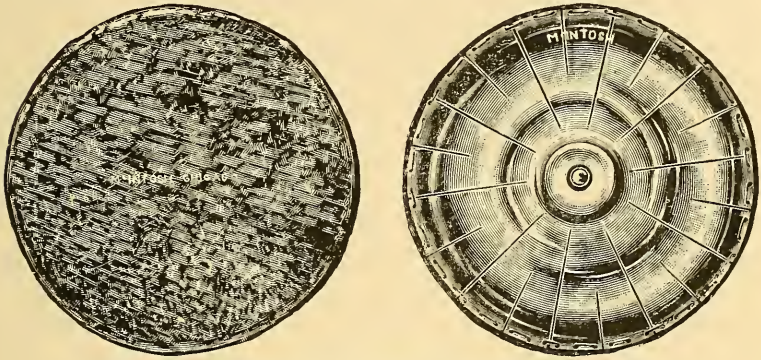


Fig. 72. Felt or sponge-covered flat electrodes, assorted sizes.

discharged cured. She was seen recently and reports that she has had no recurrence of menstrual pain.

Dysmenorrhœa Due to Inflamed Ovaries.—This condition may be recognized by the exquisite tenderness to pressure and sensations of nausea accompanying the vaginal examination. The resources of vaginal bipolar faradic sedation will commence the improvement of these cases which will go on to complete relief when supplemented by the positive galvanic current applied against the ovary. Full directions for the treatment of these cases will be found under OVARITIS. Percutaneous galvanism is also often useful as illustrated in the following case:

Miss M——, age twenty-two, referred by Dr. C. with the following letter: "Miss M. has been a victim of most persistent headache for two years—recently associated with backache and dysmenorrhea. After exhausting every theory and method of treatment which has seemed applicable I am driven by exclusion to ask you to look for and treat any existing pelvic trouble."

Examination revealed right ovary tender, swollen, and prolapsed; uterus in normal position. She received fourteen (14) applications of galvanism with the negative woven wire electrode, 2½ × 3 inches, over the ovarian region, and the positive

woven wire electrode, 3 × 5 inches, in the sacral region; current strength, 20–30 milliampéres. Discharged cured. (*Brown.*)

Dysmenorrhœa Due to Inflammation of the Tubes.—The pain caused by contraction of the orifices of the tubes or the constriction of pelvic exudations is gradually relieved during the treatment described for the inflammatory process. "Many of these cases," says Smith, "have been urged to have laparotomy performed, by others and some even by myself, and yet after from five to fifteen treatments the majority of them have remained free from symptoms for three or four years. In one of them with the uterus firmly bound down in retroversion, although the exudation was nearly all absorbed, I was never able to replace the uterus, but the patient regained her health and strength and only requires to make two visits to my office about three times a year to keep her pelvis in fair condition. I have offered to perform hysterorrhaphy, but she declines as long as she can keep so well with so little trouble."

A Discussion on Dysmenorrhœa.—To illustrate the unfortunate confusion which exists in the general relation of the healing art to dysmenorrhœa I will quote briefly from the transactions of a gynecological society in one of our largest cities.

In a paper upon the treatment of dysmenorrhœa with the galvanic current published in January, 1897, one of the members reported:

"Seventy-five per cent. of my cases have been relieved from the first, and twenty-five per cent. have required no treatment after eight or ten weeks. One or two of the greatest sufferers that have come under my care have been quite free from pain at the menstrual period for nearly three years; others returned for treatment before the expected period once a month, while some are seen only once in five or six months and report much relief. It has been my custom to apply treatment once a week for a month, and then a few days before menstruation for a few times, after which the frequency is in accordance with the indications. I have found five or six minutes long enough for each application."

The method employed by the above physician was the simple, ordinary intra-uterine application of an alterative, nutritional, galvanic current of from 15 to 20 milliamperes. If the operator, who seems to have considered that this represented about all that could be done with electricity, had employed the other familiar methods in addition, he would have secured better results in some cases, and in many other cases would have procured his best results more quickly. In still other cases in which intra-uterine *negative* galvanism is not indicated at all his patients could have been benefited by some of the other manifold means within the scope of electro-therapeutics. The remedial action of electricity in dysmenorrhœa (or in any other pelvic disease) is not exhausted by any single method, for there are three great currents, each capable of great diversity of action through diversity in apparatus and technique.

The discussion which followed the paper was participated in by nine leading practitioners. The report of the discussion really reads like a travesty upon scientific medical progress, and betrayed throughout an ignorance of the very A B C of the thoroughly demonstrated teachings of electro-physiology and clinical experience. Discussions of this character are reported in medical journals and read by physicians who are apt to assume that the floundering of the speakers in the depths of their own ignorance, and their inquiries upon points which belong to the primer stage of study, as if they were still perplexing the most scientific investigators, is proof that the whole profession is equally uninformed. Such an impression is difficult to counteract, but probably every published word would be sponged from the records by the speakers themselves if they would spend two hours' time with a reliable treatise on the subject.

At a later meeting of the same society (reported in March, 1897), the chief speaker referred dysmenorrhœa to four causes:

1. Structural lesions of the uterus itself, malformations, or an undue density of the structure of the uterus which inter-

feres with the hyperæmia that occurs during the menstrual wave.

2. Inflammatory affections of the uterus.
3. Ovarian disease.
4. Neurosis.

He considered that about one-fourth of all cases of dysmenorrhœa were of neurotic origin. The discussion developed most prominently the confusion which exists in regard to methods of treatment. Local applications, sedatives, etc., were threshed over like old straw in the usual manner, and the reason for the popularity of operations becomes clearly manifest when we carefully review some of the measures which precede them. One of the most competent gynecologists belonging to the society deliberately stated:

"My experience in the treatment of dysmenorrhœa has simply been one to disgust me with the whole subject. I have never been successful with any kind of treatment with dysmenorrhœa pure and simple. If we call painful menstruation from mechanical obstruction dysmenorrhœa, then something is to be done; the obstruction can be removed, the canal straightened out, and we get the result we might expect. But there are a number of patients who suffer with dysmenorrhœa when you can find no lesion of the uterus or its surrounding organs of any kind, and those cases I have failed to relieve in any way whatever. I have in my mind now a patient who has just left the hospital who has been operated on several times and always 'cured,' but the trouble with her cure is that she don't stay cured. She comes back, and I generally find her there at the beginning of my term of service, going through the *curing* process, and she meets me with a malicious grin as much as to say 'Now, you see I can be cured,' and she generally turns up in the next six months to meet me with the same experience exactly."

This speaker did not employ medical electricity.

In the proceedings of the same gynecological society reported in May, 1897, the paper of the evening referred to cases of dysmenorrhœa "in which the suffering begins at or soon after puberty, and continues, unless interrupted by treatment

or pregnancy throughout the whole or a greater part of the climacteric period."

The method of treatment was the injection of ten minims of a three-per-cent. mixture of Churchill's tincture of iodine and water into the uterine cavity every four or five days during the inter-menstrual period.

I shall have failed in the purpose of this book if I do not make plain to physicians more hopeful methods of treating the conditions which produce menstrual pain.

Fully two-thirds of what are now considered operative cases may also be included in the statement that the practical and simple methods described here with sufficient detail to be easily employed by any one who will procure the proper apparatus and study the rudiments of the subject will accomplish more for the relief of suffering and the restoration of the patient to comfortable health than other local measures employed in the routine manner.

The indications for the form of current, the polarity, the choice of electrodes and regulation of dose are as simple as anything in electro-therapeutics. The physician who commands the resources of electrical currents and will support them by common sense, and by hygienic, medicinal and nutritional measures when they are needed, will find himself baffled by very few cases of dysmenorrhœa.

Practically all cases dependent upon neurotic causes can be cured by the aid of the static machine and bipolar faradization.

The class of cases dependent on hyperæsthesia of the uterine membrane will be relieved by the conjoint action of bipolar sedation, and the intra-uterine application of positive galvanism.

Cases dependent upon some grade of endometritis will best be treated by intra-uterine galvanic applications with either the positive or negative pole according to the state of the tissues. The indications for the choice of poles will be found definitely stated in the chapter on Galvanic Physiology. In these cases there is almost invariably a need for bipolar faradi-

zation, and in many cases the static machine can do much to promote the general health.

When "an undue density of the structure of the uterus interferes with the hyperæmia that occurs during the menstrual wave," the physician who will study the electrolytic action of the negative galvanic current will speedily satisfy himself that it is the best resource in his armamentarium.

When displacements and structural changes of the uterus are present, and, in fact, in all conditions short of active suppuration, cystic degeneration and malignant disease, some useful service will be performed by a skilful combination of one or more of electro-medical methods.

And last, if I am asked about my own humble experience, I would say that I can recall case after case in which operative treatment has been urged by the opponents of electricity in disorders of menstruation in which perfect cures have been obtained by the aid of this harmless remedy. Cases of amenorrhœa in stout women who have been made to menstruate; in sterile women who have been made able to conceive; of women who have suffered untold agony at their menstrual period and for the most of the time between it and the next; who have been made to see the flow come on absolutely without the slightest pain—so much so indeed that instead of having a week or two of preliminary suffering it has come on without their knowing it and without even being prepared for it. (*Smith.*)

CHAPTER XIX.

TREATMENT OF UTERINE ENLARGEMENTS.

Venous engorgement of the uterus and pelvic tissues. Congestion, catarrhal inflammation, and enlargement of the uterus caused by mechanical displacement. Subinvolution. Electrical methods. Chronic sub-involution. Treatment of complications. A case of chronic metritis.

Venous Engorgement of the Uterus and Pelvic Tissues.—Prescribe remedies to regulate the action of the liver and bowels and employ vaginal bipolar faradization. Regulate the current strength for stimulating and tonic rather than for sedative effects. Repeat daily at first and later three or four times a week until circulation and nutrition become normal. Full directions for the bipolar method are described under *bipolar faradization.*

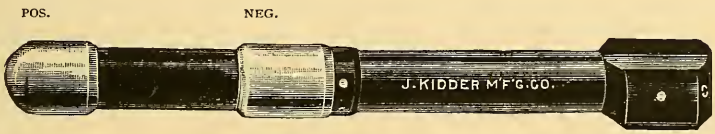


Fig. 73. Bipolar vaginal electrode.

Congestion, Catharrhal Inflammation, and Enlargement of the Uterus caused by Mechanical Displacement.—Initiate treatment with vaginal bipolar *sedation* for twenty minutes, repeated three times a week between menstrual periods until local tenderness is relieved and neurasthenic symptoms abate. If circumstances permit daily sittings they are advisable during the first two weeks.

In recent and uncomplicated cases the ultimate benefit derived from persistent bipolar faradization passing from sedative

Fig. 74. Intra-uterine bipolar electrode. (Faradic.)

into tonic and finally into muscle contracting actions may render other treatment unnecessary. In older cases we must employ additional measures.

Place a felt-covered, flat electrode, 7 × 10, on the abdomen

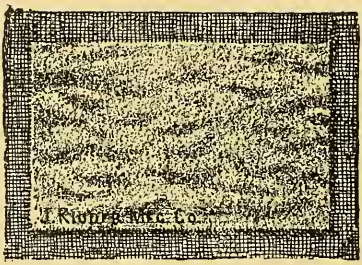


Fig. 75. Fine felt or sponge-covered electrode—assorted sizes with soft rubber insulating backs.

or under the sacrum—whichever situation brings it nearest to the fundus of the uterus. Expose the parts as usual by the aid of a speculum and swab out the vagina with a pledget of absorbent cotton dipped in a carbolic or creolin solution. Insert carefully into the uterine cavity the platinum or pure tin electrode-sound, and in all hemorrhagic conditions, or if any form

Fig. 76. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

of discharge, whether menstrual or leucorrhœal, is abundant connect it with the *positive* galvanic pole. Make external electrode negative.

Gradually increase the constant galvanic current through the rheostat from zero up to 20 or 30 mil. Maintain the maximum

current for about five minutes and then slowly reduce to zero. Entire *séance*, ten minutes.

Repeat the galvanic application two or three times weekly for several months, or until improvement is sufficient. Keep the current within comfortable tolerance at all times. In the early stages of treatment the dose may need to be kept below 30 mil., and will rarely advance beyond 50 mil., at any time, even after full tolerance is established.

When improvement is ready for *muscle-contracting* measures to supplement the constant galvanic current, switch the automatic rheotome into circuit and again increase the current strength sufficiently to produce vigorous contractions at the rate of about 70 per minute. About three minutes may be devoted to the *interrupted* current at the close of each *constant* current application. In alternation with this method it is well to continue the vaginal bipolar faradization.

If tenderness in created at any period in the course of treatment return to bipolar sedation exclusively until it is removed.

Omit galvanic treatment two days before expected menstruation, and wait a couple of days after the flow ceases before resuming, and it is prudent to limit the first treatment after menstruation to vaginal bipolar sedation only.

If the uterus has become fixed by fibrous adhesions resulting from old peri-uterine inflammation, precede the intra-uterine galvanic treatment by vaginal galvanic applications. These

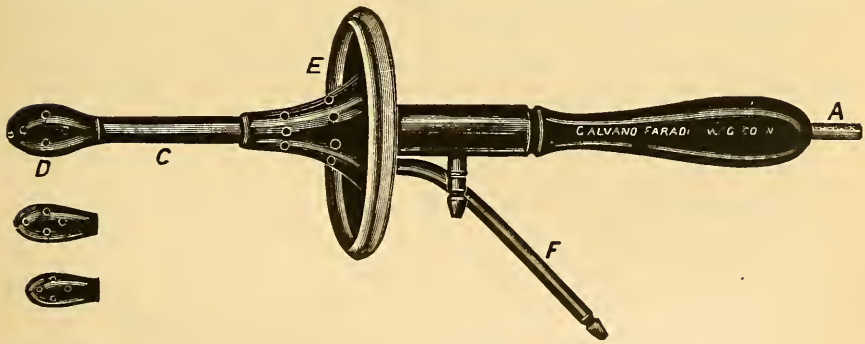


Fig. 77. Electrode for vaginal hydro-electric applications.

Fig. 78. Carbon ball electrode.

may be begun by a short course of negative *hydro-electric douches* (which see), or the carbon ball electrode wrapped with absorbent cotton may be employed as described in the section devoted to these conditions.

If the catarrhal affection has extended upwards into the tubes defer all intra-uterine methods until bipolar sedation and hydro-electric douches or vaginal galvanic treatments improve the condition and prepare toleration for other measures. Pus, if present, can be evacuated first and subsequent applications made as indicated.

If the case is mainly one of uncomplicated catarrhal hypertrophy of the uterus without free discharges they should be established by negative intra-uterine electrolysis as soon as it can be employed without irritability. Intolerance to the negative current applied with reasonable care, directed to alterative and free drainage effects, would indicate inflammation of the adnexa or suppuration in the tubes. The significance of warnings in this respect will be found among the different contra-indications and remarks on diagnosis.

In catarrhal hyperplasias of the uterus electricity has a fourfold value far exceeding the usefulness of any other therapeutic agent, for it directly combats the catarrhal process, stimulates absorption and nutrition, and by contracting the muscular fibres lessens the uterine bulk.

Among the therapeutic measures of gynecology electrical currents take easily the foremost rank in both general and special usefulness. Many of the topical applications and procedures of routine medical treatment of the pelvic affections of women appear altogether puerile in contrast with the resourceful and effective measures of electro-gynecology. It must also be said that much of popular surgery would be without excuse if both surgeons and general practitioners gave

their patients the prior benefit of medical electricity. Between the limitations of strictly medical treatment and *unavoidable* surgery of the pelvic viscera the demonstrated services of electric currents are of such scope and value as to render them indispensable. They are employed with facility and produce curative results in some conditions which are exceedingly difficult to reach by other means. They combine local and constitutional effects in the happiest manner, and they win the confidence, appreciation and gratitude of patients.

Subinvolution.—In recent cases the faradic current is indicated and may be efficiently employed by any one of five different methods, according to the judgment of the expert physician: 1. Both electrodes situated externally. 2. Mono-polar vaginal method. 3. Bipolar vaginal method. 4. Bipolar intra-uterine method. 5. Mono-polar intra-uterine method.

To these variations in the situation of electrodes may be added variations in the use of rapid or slow interruptions.

The bipolar intra-uterine method cannot always be considered safe as the electrode is difficult to sterilize. The external method with one electrode under the sacrum and the other promenaded over the fundus of the uterus is of limited service in the recent condition just after delivery. Practically almost every case may best be begun with vaginal bipolar faradization.

If the condition is a passive hyperæmia and uncontracted state of the muscular fibres requiring simply a stimulus to circulation, nutrition and contraction for its removal, the action of induction coil currents will suffice.

When more than six months has elapsed before commencing treatment and chronic changes have taken place in the structures the electrolytic action of the galvanic current will also be essential to secure results.

If the uterus is large and hard and the chronic condition is complicated the measures required during the course of treatment may call for the entire resources of the electro-therapeutist. In the following section the details of the management of a

case which demands more than bipolar faradization will be considered more fully.

Chronic Subinvolution, with or without associated flexion, version or prolapsus of any degree.

In cases in which structural changes have become more or less established through the lapse of time *commence* the treatment always with bipolar faradization.

First improve the general pelvic condition, relieve tenderness and pain if they exist, and reduce congestion and promote

Fig. 79. Bipolar vaginal electrode.

a re-absorption of the infiltrated fluids by preliminary vaginal bipolar *sedation.* Later pass to short coil stimulation.

After a very few sittings a more *tonic* action of the current will be tolerated, and in infinitely less time than any other method would produce such a result we may employ currents which will stimulate the contraction of muscular fibres. Repeat sittings three times a week and continue the bipolar method throughout the entire management of the case.

As soon as all evidence of tenderness has disappeared the tissues may be considered prepared for direct electrolytic action of the galvanic current which is *indispensable* for results in chronic cases. It must be employed hand in hand with the bipolar coil current and the actions of both supplement each other. *One lightens the weight of the uterus, the other tones up its supports.*

At the next sitting after sedation has been completed, (whether this has required a week or more depends upon the complications of the particular case) place the usual felt-covered, flat electrode, 7×10, upon the abdomen or under the lumbo-sacral spine. These situations should be alternated at different

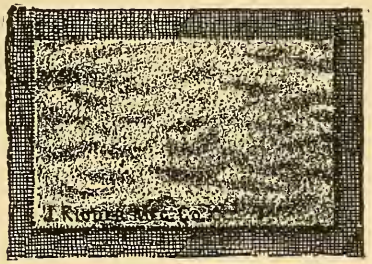


Fig. 80. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

sittings during the course of treatment so that the path of the current will not be limited to either one side or the other. This is always the rule in the treatment of chronic uterine affections. The routine of always placing the external electrode upon the abdomen is a great mistake.

Select the most suitable intra-uterine electrode-sound ad-

NEGATIVE.

Fig. 81. Intra-uterine tips for negative pole.

apted to the canal of the given case. *If the condition has been hemorrhagic or irritable, and the uterus is soft and spongy, the indications for the positive pole are absolute*, and therefore the electrode must be of platinum or pure tin. In all cases the first applications within the uterus should be made with the positive current without regard to the indications for later treatment. This rule is dictated by prudence and experience.

After cleansing the parts and sterilizing the surface of the electrode in the usual manner insert the electrode to the fundus of the uterus and connect it to the positive pole. Support it gently in position without pressure, and gradually increase the constant galvanic current through the rheostat from zero up to

20 mil. In five minutes increase it to 30 mil., which is usually sufficient for the first sitting, and if comfortably tolerated affords satisfactory evidence of the state of the tissues. After holding the maximum dose for three minutes reduce the current gradually to zero. Total length of galvanic application may vary from ten to fifteen minutes. Repeat two or three times a week between menstrual periods.

As tolerance becomes established at successive sittings the current should be increased in proportion until 60 or 70 or even 100 mil. is reached.

Immediately after withdrawing the galvanic electrodes insert the vaginal bipolar electrode and for about five minutes apply as strong a current as the tissues will accept, to contract down the uterus and drain out the canal.

When, after from six to a dozen positive galvanic applications, the hemorrhagic and spongy condition has been largely overcome, the indications for the galvanic current cease to be distinctly *positive* and may thereafter call for the *negative* current, either partly or wholly.

Cases are rare, however, in which either polarity is exclusively employed throughout any long course of treatment. They must usually alternate to conform to the varying conditions which confront the operator throughout the fluctuations of pelvic disease. The indications for the negative current are explicitly laid down in the chapter on Electro-physiology, and there is no uncertainty about when to employ negative electrolysis.

The electrodes may be precisely the same as for the positive application. The technique is the same, and the only difference in the adjustment of the apparatus consists in reversing the polarity.

In case any aggravation in the patient's condition occurs during the course of negative treatment return to the *positive* application until irritation subsides. Aggravations may occur in the uterine ill-health of women from many causes, and must be met as they occur. In speaking of them in these pages I

do not refer to such aggravation as might possibly be caused by a contra-indicated application, for the experienced operator does not hurt his patients much oftener than does the careful prescriber of any other remedy.

If the uterus, however, is found at the beginning to be dense and hard, and menstruation has been normal or scanty in amount, the indication for employing negative electrolysis *exists at the outset* and the delay in employing it need be no greater than the two or three sittings usually allowed in practice to compose the patient and determine tolerance.

When softening and electrolytic reduction of the hypertrophied organ is progressing properly, it is well to end each galvanic *séance*, after reducing the constant current to zero, by switching the interrupter into circuit and again increasing the current strength until agreeable vigorous contractions are maintained for two or three minutes. Adjust the rate of the rheotome to about 70 interruptions per minute.

Dust the site of the external electrode with toilet powder in all cases when it is convenient to do so, as this at once removes the slight itching sensation which some skins feel.

During some stages of the case the greater part of each sitting will require the bipolar method, and in other cases the chief part of the work may be done by the galvanic current. A little experience teaches the operator the exact adaptation of the technique to each case.

A reasonable time of treatment by these combined methods —varying from a dozen or twenty applications in recent and mild cases, to several months' attendance in chronic and severer cases—will accomplish more satisfactory results than can be expected from other measures. *Electricity has no peer in the treatment of subinvolution*, and any other depleting and supporting methods that the science of medicine or surgery contains can be employed intelligently at the same time without preventing the physician from giving his patients the benefit of the remedy in chief.

Complications.—" Shreds of retained decidua, a morbid

condition of the endometrium, a laceration or other traumatic accidents are often the determining cause of a septic endometritis to which the subinvolution is due."

For a septic condition of the uterus the positive galvanic current is indicated, and if there are but slight portions of retained membrane it is by no means necessary to curette. The drainage established by the galvanic application will usually suffice to carry away the shreds which the action of the current also detaches. If, however, in other cases the curette is necessary to remove larger and more dangerous fragments, it should be employed before the galvanic treatment is begun. The case will then proceed satisfactorily under the positive current.

Fig. 82. Five electrodes: insulated with soft rubber tubing to expose any desired surface.

Chronic Subinvolution with Neurasthenia.—Mrs. ——, aged 27, well nourished but emotional and neurasthenic. Instrumental delivery eight years previous was followed by sepsis.

Miscarriage two years later was followed by chronic invalidism,—cincture-like pains in loins, back and limbs, continuous slight menorrhagia and severe dysmenorrhœa, followed by leucorrhœa, uterus *hard and brawny*, corpus enlarged and tender with Os exuding copious uterine mucous. Depth of cavity, three inches. Laceration of cervix had been repaired without relief of symptoms. General electricity, massage and the "rest cure" had failed.

A negative intra-uterine application of 50 mil. for three minutes was followed by twenty hours rest in bed. Three hours after the application the cincture pain disappeared for

the first time in eight years and has not returned since. Three subsequent applications of forty, thirty-five and thirty-five mil. of the negative galvanic current were made at intervals of four to six days, alternated with faradic applications. The patient was discharged with a 2½ inch cavity and in perfect health, which a recent letter reports as permanent. (*Massey.*)

CHAPTER XX.

TREATMENT OF UTERINE DISPLACEMENTS.

Recent cases. Displacements with relaxed and congested conditions of the uterus and vaginal walls. Treatment of chronic anteversions and anteflexions. Treatment of chronic retroversions and retroflexions. Treatment of uterine conditions due to relaxation of muscular fibre and altered nutrition. Uterine prolapsus. A case of procidentia. A surgical discussion upon the treatment of retro-displacements of the uterus.

Uterine Displacements.—In simple and recent cases without adhesions or structural changes the correction of the dislocation is often admirably established by percutaneous galvanism.

Remember that the positive polar action pushes fluids away from it towards the negative pole, hence, to lighten the heavy side of the fundus, apply the positive electrode under the sacrum and the negative on the abdomen, if there is a backward displacement, and reverse this polarity if the displacement is forward.

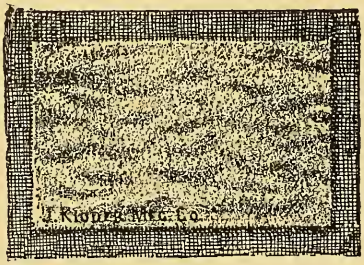


Fig. 83. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Increase the constant galvanic current from zero up to 30 mil., and after fifteen minutes reduce gradually to zero. At once switch the automatic rheotome into circuit and again

increase the current from zero until comfortably strong pulsations are felt through the pelvis. Adjust the rate of interruption to about 100 periods per minute.

After about three minutes of the interrupted application reduce the current to zero and remove the electrodes. Dry and dust the skin with toilet powder. Repeat three times a week, or oftener if convenient. Improvement will be rapid in uncomplicated cases.

In addition to immediate replacement in these recent cases, and providing support in the normal position until the local disturbance of the tissues is repaired, we have, in the well-known electrolytic and sedative-tonic effects of electricity, an auxiliary aid to nature and the tampon or pessary which practically fulfils the indications for treatment.

Recent Uterine Displacements, with Relaxed and Congested Condition of the Uterus and Vaginal Walls.—The first indication after replacement is to tone up and restore the muscular supports of the uterus and at the same time allay any pelvic congestion or irritation resulting from the accident.

The action of the percutaneous method above described is

Fig. 84. Bipolar electrode.

sometimes sufficient, but to procure these effects we also possess the more distinctly localized method of vaginal bipolar faradization. Repeat this daily for about fifteen minutes, gradually passing from the 1,500 yard No. 36 coil to the No. 32 coil as improvement advances and more tonic effects are required. When sedation is complete after the first few sittings and simple stimulation of muscular fibres to hold the uterus in place alone remains indicated, the sitting may be shortened to ten minutes and the stimulating method of managing the current employed. For full directions see BIPOLAR FARADIZATION in previous chapter.

The number of applications by these methods required to repair the slight damage of recent accidents will be very few, and in proportion as the damage is more severe or has been longer neglected, the operator may continue the treatment, according to the progress of the individual case. The usual glycerine or astringent tampon may be inserted after the withdrawal of the electrode.

If the lining membrane of the uterus is discovered to be congested or inflamed, bipolar sedation should be followed shortly by the sedative-tonic and curative action of the positive intra-uterine galvanic current with mild dosage. This application should be reserved, however, for cases in which the inflammatory state is established and not amenable to relief by vaginal bipolar sedation. When the galvanic current is employed in these cases it should precede the bipolar application at the same sitting.

Place a felt or sponge covered, flat electrode, about 6×9, on

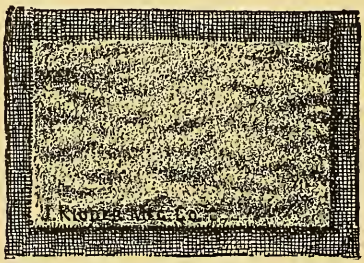


Fig. 85. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

the lower abdomen or under the lumbo-sacral region. In most cases in gynæcological practice the latter is the most convenient region, especially when small currents are employed, as the electrode may often be slipped between the clothing and the back with much less trouble than is required to open the garments and apply the electrode in front.

Connect the external electrode with the negative pole of the galvanic battery and insert the positive platinum electrode-

Fig. 86. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

sound to the fundus of the uterus. Very cautiously increase the constant current through the rheostat from zero to about 15 mil. Do not cause any pain by the application. Expect a rapid and continuous increase of tolerance during successive treatments, if the application is properly indicated and properly performed. In the absence of sufficient experience to guide his judgment without clinical tests, the operator may consider that an aggravation, if any is caused, is notice to desist. Follow the galvanic administration with the usual bipolar treatment.

Rapid restoration of the normal state of the tissues will ordinarily follow these methods of treatment in recent traumatism.

A useful inter-current method is the hydro-electric douche. Moisten a felt-covered, flat electrode, 7 × 10, in a one per cent. hot-water bicarbonate of soda solution, and apply it upon the abdomen, with the patient in the dorsal position on the operating table. Connect this with the positive galvanic pole.

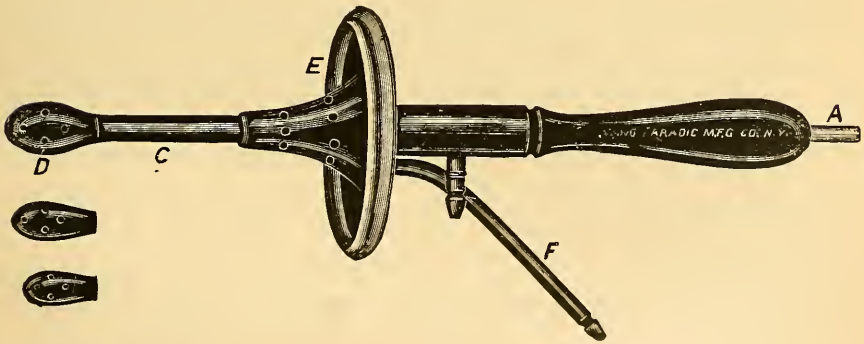


Fig. 87. Electrode for vaginal hydro-electric applications.

Prepare about three quarts of any preferred alkaline and antiseptic solution in the irrigating jar, placed at a sufficient height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal electrode and connect the electrode to the negative galvanic pole. Have the water hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Increase the constant galvanic current from zero up to about 40 mil. and maintain the current until the irrigator is empty, or for fifteen or more minutes.

Prescribe other measures indicated in each individual case, repeat some form of the electrical application daily for a few days and three times a week until recovered.

Chronic Anteversions and Anteflexions.—The treatment of these differs in degree according to the conditions present at the time the patient is first seen. A synopsis of the variations of methods usually required will be given under this one heading for the purpose of descriptive simplicity, but the judgment of the physician must regulate the applications to suit each case.

It is necessary to procure sedation of local tenderness and congestion to dilate and render the canal patulous for drainage, to soften and absorb exudative deposits and bands of adhesion which hold the uterus fixed, to soften and relax an indurated and anchored uterus, to cure the chronic inflammation of its lining membrane, if it be so inflamed, and to restore mobility and tone and strength to the uterus and its muscular supports. These steps, whether simple or complex and tedious, according to the severity of the case, come within the scope of electrical procedures, and the full plan of treatment will spring at once to the mind of the trained student of electrophysiology.

Three means of localizing polar action constitute the major measures to be employed, to wit: bipolar faradization, positive or negative vaginal electrolysis, or positive or negative intrauterine electrolysis.

Not all of these will be needed in every case, and if the malposition is not complicated by inflammation or the results of inflammation, the bipolar and negative galvanic current will do the bulk of the work. As the greater includes the less I will describe the electrical treatment of a complicated case.

Begin with vaginal bipolar faradization. By clinical test determine the sensitiveness of the general pelvic tissues and

Fig. 88. Bipolar vaginal electrode.

gradually arrive at the greatest current strength that can be well tolerated. If this proves to be only the longer No. 36 coil with an E. M. F. of four cells the faradization must be regulated for *sedative* effects at first, and gradually increased to tonic and stimulating massage effects when improvement sufficiently advances.

Bipolar rapidly interrupted induction coil current applications constitute the foundation of the plan of treatment, for the following important reasons:

1. For their primary sedative effects.

2. For their inter-current usefulness in allaying erratic or neurotic symptoms that may exist or arise.

3. For their corrective influence upon possible temporary aggravation by intra-uterine electrolysis, when this occurs.

4. For their power, in non-inflammatory states and vigorous dosage, to break up and disperse exudation material and adhesive bands.

5. For their tonic action upon the supporting structures of the uterus and the uterus itself.

6. For their tonic and nutritional effects upon the general system of the patient.

The first attention to the uterine cavity (in all cases which

require it), consists in making the canal patulous if drainage is obstructed, and allaying irritability before active treatment of metritis or endometritis is begun.

The method of dilating a stenosis of the Os or the indurated angle of an old flexion by negative galvanic electrolysis is described in these chapters under their separate headings. Employ negative dilatation when it is needed, and repeat it until the canal affords satisfactory drainage as well as the free admission of an electrode-sound.

When the canal will at first admit an electrode, in simpler versions, or when entrance has been effected in the more extreme flexions, the first intra-uterine application of galvanism should always be made with the positive pole. If there is hyperæsthesia and tenderness to pressure associated with the chronic metritis or endometritis, which exist in severer cases, the indication for mild *positive* galvanism is absolute.

If there is no observable indication for positive at the time of treatment it is a wise precaution (and my invariable rule) to test the uterine tolerance with this polarity first in all cases. Profuse menstruation in the history of these cases is also a direct indication for the continued use of the *positive* current until this sympton is abated.

With the patient in the usual dorsal position on the operating table place a large felt-covered, flat electrode, 7 × 10,

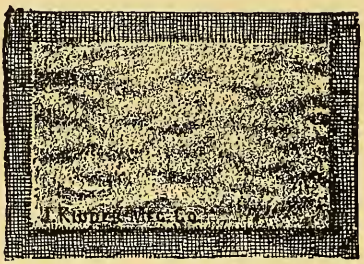


Fig. 89. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

upon the lower abdomen and connect No. 21 with the negative pole of the galvanic battery. With the usual cleanliness and care essential in all electro-pelvic work insert the intra-uterine positive platinum electrode into the cavity of the uterus

Fig. 90. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

so that metallic contact will be made with its entire lining. Gradually increase the constant galvanic current through the rheostat from zero up to about 20 mil., and maintain this dosage for five or eight minutes.

Follow this at once by ten minutes of vaginal faradization regulated in dosage to the point which experience rapidly teaches the operator is correct. At the close of the sitting insert a glycerine tampon, unless it is not considered necessary.

After each treatment the patient should experience a sense of *well-being* and a decided increase of comfort and benefit. Increase the galvanic amperage with each succeeding *séance* as fast as tolerance becomes established until finally 50 mil., and possibly 70 or 80 mil., is reached during the last half of each galvanic application. The indications for the higher intensities are clearly set forth in the chapter upon Physiological Actions.

In the early stages of treatment one other method of application may be useful, either as accessory treatment of the endometritis, or before it can be begun, or to cause the absorption of exudates or the removal of tenderness. This is *positive vaginal galvanism.*

Apply the *negative* felt-covered, flat electrode, 7×10, upon the abdomen or under the sacrum, whichever situation will best include the diseased tissues in the path of the current. Wrap the carbon ball electrode with a protecting mass of absorbent cotton securely tied upon the staff. Moisten this in the usual bicarbonate of soda solution and insert it into the

vagina (through a speculum) so that it will rest against any irritable mass of inflammatory deposit, if there be any such, or in the region of any ovarian or other congestion and tenderness. The cotton covering is far less mussy than the clay

Fig. 91. Carbon ball electrode.

which is usually recommended, and affords perfect safety against a "galvanic burn" when the ball of the electrode is carbon instead of metal, and when only moderate currents are employed. It is best not to use a metallic electrode in the vagina with galvanic currents.

The regulation of the dosage in this application will follow the usual rules, according to the size of the contact area and the pathological state of the tissues. Mild doses of between 15 and 20 mil. should be employed at first, and practice quickly instructs the physician exactly how much amperage to use at any time in the treatment of any case. Duration of sitting about 8 minutes.

The vaginal galvanic application may be followed by a glycerine tampon. It may often also be supplemented by the good effects of a bipolar faradic application. The latter does part of the work for which vaginal galvanic currents were formerly employed and displaces routine medical methods and topical applications to a very great extent.

When treatment has sufficiently subdued the chronic inflammatory condition the way has been prepared for the *softening* and *relaxing*, *absorbing effects* of *negative galvanic electrolysis*, which is the essential agent of relief.

When the inflammatory state does not actively exist at the first examination of the case the negative galvanic application can be begun usually after the second or third *séance*, and the course of treatment proceeds without the necessity for delay caused by the needs for preliminary sedation. Having initiated

treatment with the usual bipolar faradization and determined the intra-uterine tolerance with the prudent tentative application of the positive current, the operator may at the next sitting connect the intra-uterine electrode to the negative pole and employ a mild continuous current of no more than 20 mil.

Fig. 92. Intra-uterine electrodes, assorted sizes.

Handle for same.

If no aggravation occurs the amperage may be increased until it reaches 40 or 50 mil. in the course of a half-dozen sittings. Higher intensities and actively cauterizing effects are not usually desired in these cases, but when they are required the indications for them will be unmistakable to the physician who familiarizes himself with the action of different doses. Duration of sitting eight or ten minutes, allowing about three minutes for the action of the maximum current strength.

After each galvanic application benefit will be derived from ten minutes' bipolar faradization followed by a suitable tampon.

Applications may ordinarily be made three times a week between periods with a margin of two days before and after the flow.

In outlining a plan of treatment for chronic lesions which may be variously complicated and present different aspects in different cases it obviously requires medical intelligence and electro-therapeutic competency to adapt the technique to the

individual case. If initial treatment requires sedation the result will be hastened by daily sittings until the irritability, tenderness and pain are removed. The total duration of treatment will depend upon the perseverance and co-operation of the patient, and upon the skill of the operator, quite as much as upon the degree of uterine fixation and structural change.

Symptomatic benefit of great value usually appears early in the case long before anatomical improvement, and this is one of the practical pleasing features of electric treatment. Some of the described applications may require to be made but once or twice a week, and in the later stages of progress the entire treatment may be limited to two sittings per week.

Chronic Retroversions and Retroflexions.—The gross intra-pelvic indications for any one or all of the principal applications of electricity, viz., vaginal or uterine faradization, positive or negative vaginal or uterine galvanic administrations, are the same for the same method whatever may be the direc tion of the uterus.

The softening, relaxing action of *negative* electrolysis does not depend upon whether the indurated tissue is in the anterior or posterior part of the pelvis, nor is the analectrotonic, nutritional and cataphoric action of *positive* electrolysis affected by topographical situation.

In treating retroflexions the electro-therapeutist employs the same properties of current action as in the treatment of anteflexion and only modifies the technique by adapting the electrodes to the parts. He also supplements the uses of electrical currents by such other practical methods as may be indicated, and neglects nothing which can contribute to the welfare of the patient.

Commence the pelvic treatment of every new patient with vaginal bipolar faradic sedation and continue it upon the well-known principles of following up an increasing current strength so long as either the patient or the local lesion requires this

method. Gradually merge it into *tonic*, and finally *stimulating* dosage, in later *séances* during the progress of improvement.

This part of the plan of treatment is suitable to all cases,

NEGATIVE.

Fig. 93. Intra-uterine tips for negative pole.

has no contra-indications in the lesions here referred to, and should be regularly and persistently employed.

If exudative inflammatory deposits are felt about the uterus they should first be persistently attacked by combined galvanic electrolysis and osmosis, aided by the absorptive action of the bipolar method. Place a large felt-covered, flat electrode, 7 × 10, upon the abdomen or sacrum, according to the situation of the deposit, and a carbon ball electrode protected with

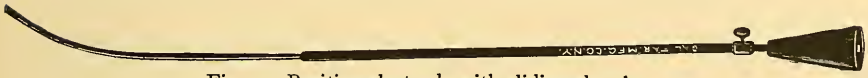


Fig. 94. Positive electrode with sliding shuttle.

a covering of wet cotton (or of clay if a high amperage is required) placed in the vagina against the mass. If this is soft, sensitive or painful, connect the vaginal electrode with the positive pole and increase the constant galvanic current through the rheostat from zero up to about 20 mil. The degree of tenderness will regulate the amperage, which must exactly reach the point of comfortable tolerance.

As improvement advances with successive treatments the sensitiveness will diminish, and the dose may reach gradually from 30 up to 40 and finally above 50 mil., and when the indications for *positive* cease, transfer the polarity to the *negative*.

When there is no longer any sensitiveness and no reaction is caused by the negative current, its use may be begun,—

with a return to the *positive* application from time to time if the need for doing so occurs.

When the mass is already painless, and dense or hard, *negative* electrolysis should be used from the start, after the routine preparation of the tissues and patient by bipolar faradization. The physiological action of the *negative* current in softening and liquefying the morbid mass and setting up absorptive processes will also be promoted by the stimulus of bipolar faradization to the pelvic capillaries and lymphatics. Exactly the same plan of preparatory *positive* and subsequent *negative* relaxing and softening applications is to be employed upon the thickened wall of the uterus and the tissues that hold it fixed.

The vaginal electrode and the technique is the same, and all the work is done at the same time, by placing the external electrode in a position which conducts the current through all the affected tissues at once. By making the cotton wrapping of the carbon ball as large as can be inserted in the vaginal cavity a greater area of contact is obtained, and this has the double advantage of carrying a greater amperage (75 or more mil.) with comfort and acting upon a greater area of tissues than would a small electrode.

In all these chronic and troublesome cases of complicated pelvic conditions when the first indication for either vaginal or intra-uterine treatment calls for *sedative* applications it is equally important to establish uterine drainage for the catarrhal secretions, and to thin them if they are thick and adhesive, so that they will readily drain away. In such a state it would be useless to apply an intra-uterine positive current and expect sedative effects. The liquefying of the tenacious secretions and the cleansing of the mucous surface must first be accomplished by negative galvanic intra-uterine applications with mild currents varying from only 10 or 15 mil., if but little action is required, up to 20 or 30 mil., according to the necessities for greater liquefying action. The benefits of the *positive* current can then be obtained.

When the uterus, if not replaceable in normal position at first, becomes more movable and can be partly or wholly supported in its proper situation, the remainder of the galvanic portion of treatment will consist of *positive* galvanic applica-

Fig. 95. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

tions to the canal to restore a healthy state of the lining membrane and aid in imparting tonicity to the uterine body. These actions are assisted by the circulatory and vaso-motor stimulation of bipolar faradization and by slow muscular contractions by the monopolar method.

These methods are so fully described elsewhere that they can be readily adapted in proper order of sequence to each individual case by any practical physician who has also a practical knowledge of medical electricity and possesses the necessary apparatus.

The *percutaneous* galvanic method is also somewhat helpful in versions and flexions both recent and old, placing the positive electrode in nearest relation to the fundus of the uterus and the negative opposite. This will tend to drive fluids from the positive to the negative region, lighten the uterus and exert a tonic effect upon the tissues. It starts a process which continues long after the current stops. It can be employed either before direct applications are begun, or when it is desired to temporarily suspend them if any reason for doing so arises.

The final results of treatment depend on both the physician and his patient. If the patient does not persist, in a very chronic and aggravated case, until the utmost possible anatomical restoration has been accomplished, she nevertheless will probably have derived very satisfactory or even complete symptomatic relief within a time which would be considered short by any physician employing other measures.

If some partial return of troublesome symptoms occurs at a

later period, it is not difficult to repeat the relief more quickly than at first, and as a practical clinical fact many women who suffer from pelvic lesions that will never be cured can be kept comfortable year after year by taking advantage of temporary electrical treatment whenever circumstances require. A symptomatic cure is almost certain.

Uterine Conditions owing their Origin Directly or Indirectly to Relaxation of Tone of Muscular Fibre.—These common affections require for the most part vaginal bipolar faradic *stimulation to nutrition*, aided at first by suitable tampon support after each treatment, if the patient has been accustomed to a pessary. *A properly used bipolar electrode in the hands of every general practitioner who treats these pelvic conditions of women would banish fifty pessaries out of every hundred* with unspeakable gratification to womankind.

Fig. 96. A proper bipolar electrode.

Attach the *positive* pole of the high-tension induction coil apparatus to the *tip* of the vaginal bipolar electrode. Make the opposite pole negative. Warm and lubricate the electrode with plain vaseline and insert it deeply into the vagina. It must be held steadily in position either by the operator or an assistant, or may be retained by the patient herself by means of the convenient handle devised by the author.

If tenderness exists it must first be corrected by a *sedative* current. When this is removed commence more tonic treatment with the 800 yard No. 32 coil current maintained at full comfortable tolerance throughout entire sitting of ten minutes. When a marked increase in tolerance denotes the preparation of the tissues for final and vigorous stimulating effects, the management of the current will be found described under the head of *bipolar stimulation* in a previous chapter.

The preparatory or sedative part of the early sittings in the

treatment of these cases should be not less than 15 or 20 minutes, repeated every second day, or at least three times a week. If circumstances permit daily applications for a short time it will be advantageous to the patient.

Tonic and nutritional applications can be limited to 15 or even 10 minutes if the current is managed skilfully. A great deal more depends upon a judicious technique than upon a given length of application.

Stimulating and muscle contracting applications need not exceed five minutes, and in cases where no sedation is required the whole sitting need not exceed ten minutes. Of this time the first half may be devoted to the usual rapidly interrupted coil current, maintained but little short of maximum tolerance, and the latter half may be devoted to the swelling method of producing powerful contractions which I have described sufficiently under other headings.

When a coil of 800 yards of No. 32 wire ceases to be effective and is scarcely felt with an E. M. F. of four or five cells, switch to the 500 yard No. 32 coil, and in time reduce this to the 300 yard No. 32 coil before passing to the coils of coarser wire, although in all cases the practised operator rapidly selects the right coil with scarce a moment's delay. Tissues which at first were congested and tender will finally become so firm, healthy and hardy that they will tolerate a current through only 100 yards of No. 16 wire coil with an E. M. F. of from three to four cells regulated through the rheostat.

In the treatment of these cases the advantages of the large variety of coils which are now an essential part of a high efficiency induction apparatus are most admirably shown, for while the best common faradic battery is scarcely usable at all in gynecology *the high efficiency induction apparatus will accomplish results of priceless value.*

While some of these results become commonplace to the few who appreciate the methods above described (for they are obtained with such readiness and facility as to no longer excite remark), yet they would be heralded as a remarkable advance in

medicine if they could be procured by any other method employed in either medicine or surgery.

If a supporting tampon is advisable during the first week of bipolar treatment it will soon cease to be necessary and the patient rejoices at the fact.

In the successful treatment and relief of symptoms of all forms of flexions, versions and prolapsus, as well as subinvolution and the pathological conditions resulting from it, this method of applying tonic electrical massage to the weakened muscular fibres is an important part of the necessary procedure. In cases which require the additional action of galvanic currents the faradic current is nevertheless often indispensable to the relief or cure.

A *bent* uterus may be given superb exercise to strengthen its muscle fibres by inserting the intra-uterine bipolar electrode and employing a slowly interrupted coil current with dosage adapted to tolerance. It is perfectly comfortable to the patient. Short *séances* of three to five minutes are sufficient, repeated daily at first and later three times a week.

Fig. 97. Intra-uterine bipolar electrode. (Faradic.)

Uterine Prolapsus.—The treatment of any prolapsed condition of the uterus resolves itself into the use of the galvanic current to reduce weight, and the faradic current to strengthen muscular supports. Even in aggravated cases, when the pelvic floor has been badly torn, with both cystocele and rectocele prominent, excellent palliative results can be rapidly obtained by the use of electricity alone.

In a case of this kind I have seen pain and tenderness completely relieved at the first sitting and a dozen treatments restore to the patient the power to perform her household

duties with comfort without any surgical operation whatever. Too much cannot be said of the comfort-restoring capabilities of electrical methods in these cases, for although an operation may be apparently necessary yet the patient may either object to it or be unable to have it performed.

Methods of treatment are made sufficiently plain in discussing other displacements and need not be repeated here. Always begin with bipolar faradization. Even if the patient needs and desires to have a perineum sutured it is better to precede the operation and put the tissues in the best possible state by a course of local treatment with electricity.

NEGATIVE.

Fig. 98. Intra-uterine tips for negative pole.

Procidentia.—Mrs. ——, age 50. Procidentia, two inches, cystocele, rectocele, varicose vulva, bilateral laceration of cervix, laceration of perineum nearly to sphincter ani, uterine cavity 4½ inches. Duration of lesions twelve years.

I at once began vaginal bipolar faradic stimulation with short, coarse secondary coil. This had a marked effect, contracting the muscles so that the electrode could be felt drawn firmly upward. After the first application the uterus remained up for two hours. Repeated ten minute applications of the same nature every second day for the first month, at the end of which time the uterus did not come down at all.

Mrs. —— now felt very much relieved and more able to do her work, but complained of a dragging, tired feeling when she remained long standing. *The faradic current had strengthened the uterine supports, but had not lessened the weight to be supported.*

I therefore began *positive* intra-uterine applications of the constant galvanic current with the platinum sound electrode,

60 mil., for ten minutes every four or five days between the menstrual periods. After ten *séances* her period lasted only three days instead of eight as formerly. Three months later she reported that she was feeling better than ever before, and she certainly now looks ten or fifteen years less than her age.

This is just one of a class of cases that come to the practitioner's office every day and which give (without electricity) a great deal of trouble and very unsatisfactory results. Most often they decline any operation and the time-honored pessary will not only not hold the uterus up but will not even hold itself *in*. For such cases the electrical treatment is most rational, for without cutting away any part of any organ it restores to the supports their lost tonicity, removes from the uterus its morbid weight, increases the vitality of the tropic nerves, and calls back into the circulation the morbid material stagnant in the tissues.

In cases without hypertrophy the induction coil currents will suffice to restore the prolapsed organ to its normal position, as I have witnessed many times; but in other cases it is absolutely necessary to reduce the size and weight of the uterus by the action of the galvanic current.

Other satisfactory effects in this case, which I have also noticed in many others, were the decided feeling of well-being after the galvanic application, and also the tonic action upon the bowels. (*Smith.*)

A Surgical Discussion upon the Treatment of Retro-displacements of the Uterus.—Before considering the practical utility and satisfactory service of electric currents properly employed in the treatment of these common lesions it will emphasize the contrast between routine methods and electro-therapeutics to call to mind the ordinary recommendations.

Instead of advancing any personal opinion, however, about the value of some other measures it will be more forcible to quote from an advocate of one of the special surgical operations who considers all non-electrical methods of treatment at some length in a recent Journal article, and omits to point out

the demonstrated fact that electric currents will give the relief that is needed in almost every ordinary case.

Perhaps there is no condition in the female pelvis which has occasioned more discussion than that of backward displacement of the uterus. We are told by nearly all writers that before taking into consideration any operative procedure for the cure of this affection we should, if possible, place the organ in its normal position by bimanual manipulation and retain it there for several months by means of pessaries or tampons until the round ligaments and other supports have had a chance to regain their natural tonicity. We are then told that should this fail we are justified in considering some operative treatment for the patient's relief providing the symptoms are sufficiently troublesome in warranting us in subjecting her to an operation.

I cannot agree with such advice. It is true that by means of bimanual manipulation, aided if necessary by the use of the sound or some form of uterine repositor, we can in simple cases in which no strong adhesions exist place the uterus in a fairly normal position. We can also by means of a well-fitting pessary or judiciously applied tampons, provided the pelvic floor is intact, oftentimes hold the uterus in position. It is also true that by the long-continued use of such supports, combined perhaps with pelvic massage we can do much to improve the tone of the ligamentous supports of the uterus. The patient for the time being feels better, many of the troublesome symptoms have been relieved, and, as she is not willing to submit to tamponing or wearing a pessary *ad infinitum*, we cease the tamponing or remove the pessary, and hope that our months of patient toil have not been in vain. We request the patient to return to us in a few months, in order that we may ascertain whether the uterus has remained in its normal position or not, and we are disappointed to find that usually it has not and that the patient begins to feel some of her old symptoms returning. Then in desperation we advise the patient to have the condition cured by operation. She probably goes away from our office disgusted with us for having subjected her to months of futile treatment. Personally I think it would have been much more satisfactory if we had advised operation at the outset. We often find in our cases of retro-displacements some injury to the pelvic floor which weakens its supporting power, and before we can hope to keep our tampons or pessary in place it must be repaired, and when the patient must be subjected to operation for this the operation for the direct relief of the malposition may just as well be undertaken at the

same time. The use of pessaries, tampons, pelvic massage, etc., appear to me to be simply makeshift, giving, it is true, much temparary relief, but rarely if ever effecting a permanent cure, unless the patient is willing to wear some such support constantly. This being the case, it does not seem fair to me to subject our patient to troublesome treatment which promises so little, when we have at our disposal an operative measure which, if carefully performed, has no more risks than the ordinary plastic operations.

Let us consider then the prominent operative procedures for the cure of retro-displacements. We have:

1. Alexander's operation, by means of which the round ligaments of the uterus are shortened extra-peritoneally.

2. Wylie's and Dudley's operations, in which the round ligaments are shortened intra-peritoneally. (Wylie scrapes the inner side of the round ligaments so as to make the surfaces raw, folds them external to the uterus, and passes three silk ligatures around each fold. Dudley, on the other hand, folds the ligaments in front of the uterus, and attaches each fold by two silk ligatures to the surface of the uterus.)

3. Hysterorrhaphy, or ventral fixation, in which the fundus of the uterus is fastened to the anterior abdominal wall.

4. Vaginal fixation, in which the fundus of the uterus is fastened to the anterior vaginal wall.

In speaking of the Alexander operation I believe we have a better procedure and one which is more satisfactory in its technique and results. I would like briefly to enumerate some of the objections to the Alexander operation. . . .

Wylie's and Dudley's operations while ingenious, and while they have the advantage over Alexander's operation in that, it being necessary to open the abdominal cavity to perform them, any existing adhesions may be broken up, have still but little to recommend them. In ventral fixation we have an operation which undoubtedly effects a permanent cure in cases of retro-displacement. It is doubtful however if so far as results are concerned it has much advantage over vaginal fixation. When vagino-fixation was first performed the sutures fastening the uterus to the vaginal wall embraced the fundus too high up, promoting possibility of complication at future pregnancy. As it is now performed I think it will interfere little if at all with pregnancy should this condition supervene. The possible danger in this operation is injury to the bladder, etc., etc., etc. (*Wakefield.*)

When all suffering has been removed and a symptomatic cure effected by appropriate uses of galvanic and faradic cur-

rents from improved apparatus the degree of malposition which remains becomes of no consequence to the patient. In these cases an anatomical restitution of the parts to the flawless state of childhood is too utopian for practical physicians and their patients. A woman with a flexion which gives rise to no more symptoms generally feels satisfied with the results of treatment, and the physician who witnesses the satisfactory results achieved by electrical methods will feel little need to rely upon other means to relieve his patients who suffer from ordinary displacements and flexions.

The reader who wishes to refer to the Carlet thesis on Electrical Treatment of Fibroids will find a great number of cases reported, not only of fibroids but also of endometritis and enlargement of the uterus, in which the organ was restored to its normal size. I have also reported a great many cases of displacement due to enlargement of the uterus which were cured by reducing the weight of the uterus by means of the continuous current and afterwards strengthening the support by the aid of a coarse interrupted current.

When the enlargement is due to subinvolution the interrupted current acts very well by setting up powerful contractions of the uterine muscle, thereby cutting off the too great supply of blood to the sinuses and causing fatty degeneration and absorption of the superfluous muscular tissue. When the enlargement is due to areolar hyperplasia the interrupted current is useless as only the continuous current will cause absorption of fibrous tissue. (*Smith.*)

The discussion of the relative merits of these operations must now be carried to a higher plane than that of mere technique and of immediate and remote anatomical results. Their greater or less interference with the functions proper of the uterus, child-bearing and child-birth constitutes the higher standard by which they must be judged.

In pregnancies following vaginal fixation of the uterus there have been recorded: Disorders and pain in the vaginal cicatrix, abortions (twenty-five per cent. and over), vesical pain and disturbances of micturition, transverse presentation, prolapse of funis, very difficult version due to abnormal conditions established by vaginal fixation, severe post-partum hemorrhage, rupture at site of cicatrix, delivery per vaginam impossible, Porro operation, rupture of vagina, death from intra-peritoneal hemorrhage, etc., etc. . . . Other cases of serious disturbances of pregnancy and parturition were brought

to light in the discussion, and anxiety was expressed for the ultimate fate of the already numerous victims of the yet young operation. Bockelmann estimated that there were in Berlin alone about one thousand women with the dire possibilities of vaginæ-fixura gestation and delivery ahead of them. In New York there are perhaps two hundred such unfortunates. Who will dare to add to their number? With the evidence now in, I will neither perform nor sanction in consultation vaginal fixation in a woman liable to future pregnancies. Mackenrodt, one of the originators and chief champions of vaginal fixation, has formally disowned the operation for the reasons just recorded.

Applying to each of the three operations the crucial test of interference with the normal course of subsequent pregnancies vaginal fixation must be discarded altogether in women liable to future pregnancies, and vental fixation must be viewed with strong distrust.

Neither vaginal fixation nor vental should be performed upon a woman liable to future pregnancies for the cure of an uncomplicated retroversion of the uterus. (*Edebohls.*)

CHAPTER XXI.

TREATMENT OF ENDOMETRITIS AND UTERINE INFLAMMATIONS.

Recent and simple endometritis. Endometritis in young girls. The treatment of chronic endometritis. Endometritis associated with slight metritis. Endometritis complicated by a salpingitis or other peri-uterine inflammation. Hemorrhagic and fungous endometritis. A clinical hint. Catarrhal inflammation with profuse leucorrhœa. Chronic endometritis of the cervix with erosion, induration and unhealthy granulations. Chronic endometritis of the cervix with erosion, œdema and soft, swollen state of the tissues. Chronic uterine hyperplasia with uterus large and soft; with induration; with extension of inflammation to the tubes and ovaries. Gonorrhœal metritis.

Recent Endometritis.—Recent and uncomplicated inflammation of the endometrium, or the body of the uterus, or of any pelvic tissue, requires no peculiar modifications of technique in electrical treatment but follows the usual rules of combating inflammation anywhere.

When the physician has prescribed appropriate auxiliary measures the chief local remedy for its sovereign power to relieve pain, to arrest acute inflammation and promote resolution, is *vaginal bipolar faradic sedation* applied with proper apparatus and proper gentleness and persistence. Intra-uterine electrodes are contra-indicated.

The use of an obsolete type of large, heavy, bipolar electrode and the current from a common faradic battery will be harmful. To benefit the case we must use the induction apparatus with improved rapid vibrator and fine coils, and the very light and correct form of electrode.

The application requires only the care and prudence of reasonable skill to make it a sovereign remedy in acute pelvic inflammation. The indications for choice of coil, for duration of

séance and frequency of treatment are the same as those of acute, inflammatory and painful states elsewhere.

Warm and lubricate the bipolar electrode, insert it gently to its greatest depth and let it be maintained in the most comfortable position by the limbs of the recumbent patient. No assistance is required.

Fig. 99. A proper bipolar electrode.

Switch into current the perfectly adjusted rapid vibrator and 2,000 yards of fine coil. Switch an E. M. F. of four cells into action and control the current through the secondary circuit rheostat. Commencing at zero follow out carefully the principle of securing sedation and local anæsthesia by a current strength which is not only never painful but which becomes agreeably and progressively soothing.

Maintain it at the point of comfort for a long time—fully an hour may be required at first—until it has relieved the pain and diminished the congestion and leaves the patient comfortable after it has reduced to zero.

When pain reappears some hours later repeat the application in the same way. While the galvanic current is not available in these acute inflammations and the faradic current was never available until it was refined and perfected by perfected apparatus, it is now a most important means of checking an inflammatory process and lessening the number of cases which become chronic.

Simple Endometritis in Young Girls.—Percutaneous galvanic applications are often adequate treatment in these cases unless the condition has become too chronic and has progressed to metritis. Unless therefore some enlargement of the uterus is discovered external applications may constitute the treatment.

Moisten a felt-covered, flat electrode, 7 × 10, in the hot-water soda-bicarbonate solution, connect it with the positive pole of the galvanic battery and place it under the lower spine with the patient in the dorsal position on the operating table.

Prepare a similar electrode in the same manner about 5 × 7, connect it with the negative pole and apply it with firm contact

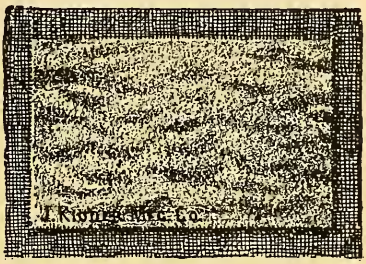


Fig. 100. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

over the hypogastrium. Retain it in position by the weight of a small shot-bag.

Gradually increase the constant galvanic current from zero up to about 20 mil. In two minutes again increase the current and slowly reach the point of comfortable tolerance. In about ten minutes reduce gradually to zero, remove the electrodes, dust the skin with toilet powder and close the sitting.

Repeat every second day between menstrual periods until recovered. It is obvious that this form of treatment may be employed before even a local examination is made, and in the class of cases in which it may suffice for treatment the local examination may be reserved until it is found to be necessary. Always prescribe hygienic and medical measures for the regulation of the abdominal and pelvic functions, so that all the resources of good therapeutics will be helping the patient at the same time.

Chronic Endometritis.—Electricity in some form is absolutely indispensable to the treatment of chronic endometritis. To ignore this fact is about like ignoring quinine in malaria. Malaria can be treated without quinine but not so well,

Auxiliary measures may be employed in the usual manner according to the indications of a given case. The technique of the electrical portion of the treatment is as follows:

Begin at the first sitting with vaginal bipolar faradic sedation, and if congestion or inflammation of the peri-uterine tissues is sufficiently active and troublesome long sittings of

Fig. 101. Bipolar vaginal electrode.

20 or 30 minutes should be made daily instead of the routine three times a week. The first indication is to allay the irritability and remove tenderness and pain.

After the No. 36 coil ceases to be appreciable and the 800 or 500 yard No. 32 coil with a full E. M. F. of four or five cells is thoroughly tolerated it may safely be assumed that the tissues are prepared for intra-uterine galvanic applications which are essential to the cure.

There are now two variations of method, one advocated by Apostoli and the other known as *metallic electrolysis*. In some cases one is preferable to the other and will produce the quickest and best results, and in clinical practice the operator readily learns when to choose between them.

The Apostoli method employs the positive polar action with *non-attackable* platinum electrode for short *séances* of five or eight minutes with a dosage of from 30 to 50 mil., or with shorter applications of about three minutes with higher intensities ranging from fifty to seventy-five and one hundred or more mil. at different stages in the treatment of different cases.

Metallic electrolysis involves the use of *oxydizable* electrodes of zinc, copper or zinc amalgamated with mercury, with milder currents of from 15 to 30 mil. Metallic electrolysis is aseptic and germicidal and is employed chiefly for local and superficial

effects upon mucous surfaces in states of catarrhal inflammation. It is not employed for the deeper electrolytic action and for the active cauterizing effects which the Apostoli method may be caused to produce by its increased dosage.

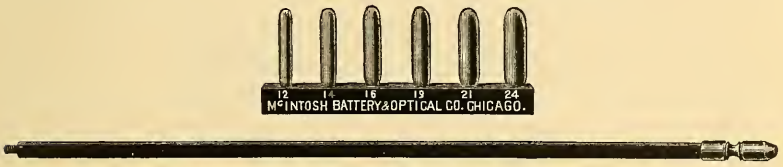


Fig. 102.

Whichever electrode and method is selected the end sought is nearly the same and the technique is practically similar except in the regulation of the dose.

It consists in either case of applying a large felt-covered, flat electrode, 7×10, externally upon the abdomen or sacrum (or both if above 60 mil. is to be used), inserting the positive electrode to the fundus of the uterus, switching the desired number of cells into circuit and gradually increasing the current through the rheostat from zero up to the desired dose, and after maintaining this for three, five or in some cases eight minutes reducing to zero and closing the sitting.

The management of copper and zinc electrodes which adhere to the tissues is fully described under METALLIC ELECTROLYSIS, to which the reader is referred.

The management of the Apostoli method with the platium intra-uterine electrode is the same in all cases for which it is used, whether chronic endometritis, chronic metritis, fibroid tumor or other lesion; and the only difference relates to employing *different doses in different cases.*

If only a mild caustic and alterative effect is desired to correct a superficial endometritis the dosage does not need to be increased above 20, 30 or 40 mil. If a gross destruction of morbid tissue is desired, as in the case of an advanced fibroid tumor, the dose must go to the highest possible tolerance and often reach the maximum employed in medicine.

Between these two extremes of current action there is a wide

range of electrolytic work which calls for currents of from 40 to 100 mil., and the physician who studies with some care the demonstrated physiological actions of the galvanic current will have little difficulty in regulating the dose in his cases of endometritis and benefiting the condition which appears.

The sittings should not be oftener than twice a week when medium galvanic currents are employed, and not oftener than once in six or eight days when high intensities are used. Immediately after the galvanic electrodes are removed a short bipolar application should follow, and sittings devoted entirely to bipolar faradization should be made regularly about three times a week during the entire course of active treatment until pain and tenderness are removed.

If in rare cases the uterine membrane contains fungi which require removal by the curette, the operation may advantageously be followed by positive galvanic cauterization of the surface. This controls the bleeding and starts up a healthy reaction.

"*There is no doubt that when properly used galvanic applications constitute the most satisfactory and successful treatment of endometritis,*" is the concurrent testimony of every experienced physician who speaks from practical work.

The methods of metallic electrolysis are often so effective in catarrhal inflammations of mucous membranes and with mild currents that the use of 150 to 250 mil. so frequently advised a number of years ago is now superseded by simpler methods in the majority of superficial catarrhal inflammations. Very high dosage is rarely needed, and the general practitioner will be able to do most of his pelvic work with less than 100 mil. and a large percentage with less than 75 mil.

Cataphoric Method.—It remains to describe an alternative application to the diseased mucous membrane which partakes somewhat of the nature of metallic electrolysis and is immensely superior to any superficial use of the tincture of iodine upon the surface by the time-honored applicator.

Quite a variety of remedies (tincture of iodine, carbolic acid,

etc.) have been experimentally employed, but it is doubtful if a strong solution (ten to thirty per cent.) of iodide of potassium is not superior to them all.

Moisten a felt-covered, flat electrode, about 6 × 9, in the usual

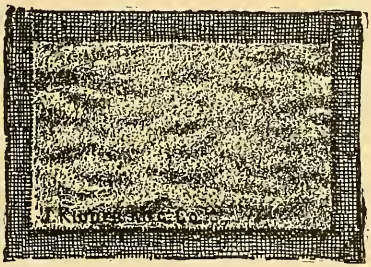


Fig. 103. Fine felt or sponge covered flat electrode—assorted sizes with soft rubber insulating backs.

hot-water solution of bicarbonate of soda, connect it with the negative galvanic pole and apply it either upon the lower abdomen or under the sacrum.

Wrap a light layer of absorbent cotton around the spiral electrode made especially for this purpose, connect it with the

Fig. 104. Aluminium cataphoric uterine electrode screw tip.

positive pole, dip the cotton in the iodide solution and insert it as desired. In cervical endometritis it may be applied only as far as the internal Os. In corporeal endometritis it should reach all the diseased membrane.

Gradually increase the constant galvanic current from zero up to comfortable tolerance, which will develop in different cases from 25 up to 50 or 60 mil.

The general principles of treatment conform to the usual rules. In some cases the method possesses advantages and appears to produce results superior to the action of the current alone. The same method may be employed in urethritis with about one-half the current strength.

Simple Endometritis associated with Slight Metritis.—If

menstruation is profuse, the first intra-uterine treatment should be with the positive galvanic current. If marked tenderness and other indications for bipolar faradic sedation are present commence the treatment with the vaginal bipolar electrode and the 1,500 yard No. 36 rapidly interrupted, secondary coil current as described under *faradic sedation.*

If there are no indications for delaying the direct treatment of the endometrium commence the second sitting with a negative felt-covered, flat electrode, about 6×9, upon the abdomen

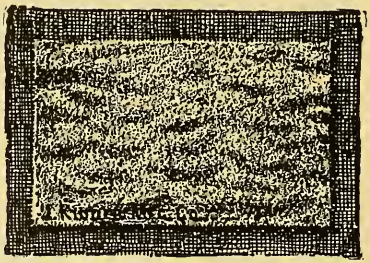


Fig. 105. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

Fig. 106. Long tin tip intra-uterine electrode.

with a platinum or pure tin electrode connected with the positive pole and inserted carefully into the uterine canal.

Gradually increase the constant galvanic current through the rheostat from zero up to 10 or 15 mil. at the first sitting. If the case is a mild one and tolerance gradually increases the current strength may be slowly raised to 30 or even 40 mil. with sittings of about five minutes repeated twice a week.

If however the condition is not associated with menorrhagia, but on the contrary the indication is to favor drainage and promote a freer discharge, the intra-uterine electrode should be connected with the negative pole. The dose regulation and other principles of technique are the same in either case. The

well-known indications for the positive current will always guide the operator to its selection, and the equally well-known indications for mild negative electrolytic and alterative action upon the diseased endometrium make the choice of this pole perfectly clear. The clinical results are good.

Endometritis Complicated by a Salpingitis or other Peri-uterine Inflammation.—Whenever the first examination reveals a fixed uterus and surrounding complication the intra-uterine treatment should be postponed until vaginal bipolar faradization and vaginal negative electrolysis have first allayed irritability, congestion, pain and tenderness if these exist and restored mobility to the uterus by softening and promoting the absorption of exudates. The exact methods of technique have been so frequently described in other places that they need not be repeated here. See chapter on PERI-UTERINE INFLAMMATION. When the cotton-wrapped carbon ball electrode can be

Fig. 107. Carbon ball electrode.

employed directly upon adhesive fibrous bands with about 75 mil., the softening and relaxing effect is very rapid. Attack pain first, immobility next and finally the uterine canal. The vaginal hydro-electric douche can be employed before the carbon ball is tolerated.

Hemorrhagic and Fungous Endometritis.—At the first sitting employ vaginal bipolar faradic sedation if the patient is not in immediate need of measures to arrest hemorrhage.

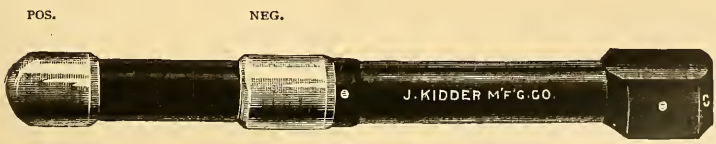


Fig. 108. Bipolar vaginal electrode.

If any pain, tenderness or other indications exist for continuing the induction coil current the bipolar method should be repeated at least every second day until the patient is prepared to accept the essential curative treatment which is the positive intra-uterine galvanic current.

The amount of preparation necessary before commencing intra-uterine treatment may be only a single bipolar application in one case, while in other cases the patient may be in a state which requires an intermediate use of the galvanic current by either the percutaneous or vaginal methods.

The activity of the intra-uterine dosage when the positive current is employed is governed by the activity of the bleeding until this is thoroughly controlled. If there is merely a rather profuse menstruation the dosage will be moderate, while if there is an actively bleeding surface the treatment must push the astringent action of the positive pole to the point of maximum tolerance. It thus acts as a "chemical curette."

The value of the positive galvanic current in stimulating contraction and interstitial absorption after the bleeding is arrested makes it the best remedy for all varieties of conditions classed under this heading. As the management of the case follows the general principles of treatment it is not necessary to repeat the directions here. It is sufficient to say that probably no other method will be so certain of action, so free from risk and so satisfactory to the patient.

In all intra-uterine applications begin with a small amperage (15 to 25 mil.) and test the tolerance before employing high intensities. If fungosities still bleed have the curette used and then proceed with positive galvanism.

Remarks.—Intra-uterine positive galvanic applications of from 50 to 100 mil., in cases of endometritis, metritis, etc., set up decided contractions and shut down the uterus on the electrode so that in withdrawing it the tissues may seem to hold it in a firm grasp. Always use care in removing it and reverse the current if necessary.

The negative polar action does the opposite of this, relaxes

the tissues, makes the canal more patulous and causes a creamy discharge by its alkaline electrolysis.

Catarrhal Inflammation of the Lining Membrane of the Uterus with Profuse Leucorrhœa.—Begin treatment, *as usual in all cases associated with pain and tenderness,* by vaginal bipolar faradic sedation and continue with this until congestion, tenderness and acute symptoms are allayed. Daily applications hasten these results in private practice, although clinic patients are rarely treated oftener than three times a week.

When the patient is ready for direct local treatment of the catarrhal condition the first step requires free drainage. If the canal is constricted in any part, or if the secretions are too thick and tenacious to drain away, the preparatory application of the negative galvanic current with an intra-uterine sound and 15 or 20 mil. for eight or ten minutes is necessary. This may be repeated two or three times if otherwise the conditions would prevent the essential contact of the positive electrode with the clean and free surface of the mucous tissues.

The curative intra-uterine treatment to follow these preparatory measures consists of (1) positive galvanic applications of mild dosage 20 to 40 mil. for five or eight minutes with a plantum electrode, repeated three times a week, or (2) metallic electrolysis, repeated at intervals of from four to six days until improvement ceases.

Cupric electrolysis is preferred when a soft and boggy state of the tissues exists, zinc in sclerous conditions, and zinc amalgam when the discharge is muco-purulent or purulent.

Both copper and zinc electrodes adhere to the tissues when held stationary during the action of the galvanic current and must be loosened by reversing the polarity at the close of the application. Zinc amalgam does not adhere, and possesses also the advantage of a lubricated surface which enters readily. The methods are practically alike in details of administration apart from the different dosage employed.

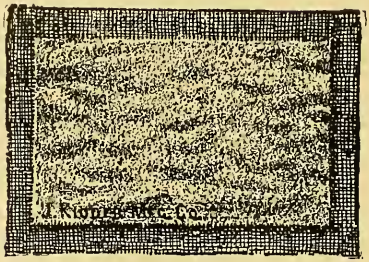


Fig. 109. Fine felt or sponge covered, flat electrode—assorted sizes with soft rubber insulating backs.

Place a large felt-covered, negative electrode upon the abdomen or sacrum, and usually these positions should be alternated during any extended course of treatment for most pelvic affections of a chronic nature.

If either the platinum intra-uterine electrode, or one of copper, zinc or zinc-amalgam is selected, connect it with the

Fig. 110. Zinc and copper tip intra-uterine electrode.

positive galvanic pole and insert it to the fundus of the uterus in the usual manner. If it does not readily enter the canal in any case, it is always a neat point in practice to carry the electrode into the canal with the aid of about ten mil. of negative current, which may be at once reduced to zero after it has served its purpose.

With the electrodes now in position increase the positive galvanic current through the rheostat from zero up to a dosage which different degrees of tolerance (as improvement progresses) will carry along from 20 to 30 or 40 mil. Maintain the maximum current for five minutes. Whenever a milder dosage

is found to lack effectiveness at any stage of treatment larger currents can be used with either the platinum or zinc-amalgam electrode, but the need of an amperage much above 40 mil. is exceptional in this class of cases.

If complications exist with the catarrhal condition they will require other measures, but in simple cases a couple of months' treatment between menstrual periods will produce satisfactory improvement.

Chronic Endometritis of the Cervix, with Erosion, Induration and Unhealthy Granulations.—Commence treatment with vaginal bipolar faradic sedation, and if local tenderness, inflammatory or neurotic disturbances require a course of preliminary treatment continue bipolar sedative and sedative-tonic applications p. r. n.

Fig. 111. A proper bipolar electrode.

As soon as the active local treatment can begin (and at the second sitting if nothing else interferes) place a large felt-covered, flat electrode, 7 × 10, upon the abdomen or under the sacrum and connect it with the positive pole of the galvanic battery.

Select a bare metal electrode-sound of sufficient size to make contact with the whole cervical canal. After adjusting the

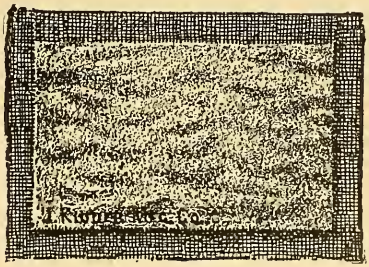


Fig. 112. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Fig. 113. Intra-uterine electrodes.

speculum and cleansing the parts with creolin or carbolic solution insert the electrode within the canal, connect it with the negative pole and increase the constant galvanic current through the rheostat from zero up to about 15 or 20 mil. at the first sitting. Maintain for five or eight minutes and reduce to zero.

Change the sound electrode to the largest blunt tip of the copper or zinc set and treat the eroded tissues around the ex-

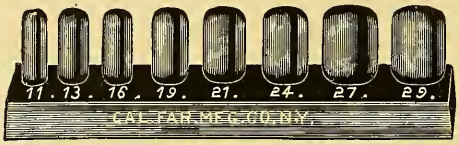


Fig. 114. Short copper or zinc bulbs.

ternal Os with a current of about 15 mil. Hold the blunt end of the electrode stationary upon each part it covers for about one minute and slowly rotate it over all the diseased area until the entire surface is treated with negative electrolysis.

Repeat these applications at intervals of from four to six days according to the progress of the case.

So long as the general condition of the pelvic structures derives benefit from the sedative-tonic, nutritional bipolar faradization, increased in dosage as improvement permits increasing stimulation, follow each galvanic sitting with about ten minutes of the coil current.

If the galvanic applications are a week apart two inter-current bipolar treatments may be given with decided advantage.

The practical merits of this plan will be apparent in the gain in the general health, sleep, appetite, nutrition and composure of the patient, and these benefits will in turn help nature to repair the local damage. The bipolar application *treats the*

patient rather than the cervix, but is worth far more than a host of other topical remedies which are extravagantly praised.

In any aggravated case the patient should be under observation three times a week, and treated with the bipolar induction current and such other measures as can be employed to fulfill the indications.

The second galvanic application to the cervical canal will permit an increase of the dose to 20 or 25 mil., and if this is well tolerated the operator at the next sitting is able to go to 40 or 50 mil.; he is assured of safety in rapidly increasing the dose beyond electrolytic and caustic effects into a cauterizing current, to soften the tough superficial tissues, cut down unhealthy granulations and establish a healthy reaction.

As soon as this is effected and proper vascularity begins to show on the erosion wait to observe the extent of healing before cauterizing the surface again. Three or four thorough negative applications of as strong a current as proper cauterizing action requires will generally stimulate the healing process except in some fissure or limited area which has not come in contact with the electrode. Special applications should be made to these upon the same principle, but with the metallic surface of the electrode fitted to close contact. After obtaining a satisfactory start the applications to the cervical canal may be made about once a week for continued galvano-caustic effects until satisfactory improvement is obtained.

Chronic Endometritis of the Cervix, with Erosion, Œdema and Soft, Swollen State of the Tissues.—As induration is often a keynote to the choice of the negative galvanic polar action, so is the opposite state a keynote for positive polar action. Indeed the cases are not few in which the conditions are so associated as to call for inter-current applications of the polarity which is not indicated in chief, and the fact that both polar actions harmonize with physiological efforts of nature to restore the sound state simplifies the matter of selection for the physician. When there is present one or more of the major indications for either positive or negative galvanic

action there is seldom any liability of harm resulting to the uterine tissues, and the probability of benefit beyond the mere local indications is very great. (See chapter on GALVANIC ELECTRO-PHYSIOLOGY.)

Begin the treatment of the patient with vaginal bipolar faradic sedation as usual in almost all cases of pelvic disease. Close the sitting with a carbolic and glycerine tampon, and employ any other aid to treatment which the local or general state of the patient calls for. When local tenderness and irritation have been sufficiently controlled by bipolar faradic applications (or if they have not been present), the galvanic part of the treatment may begin.

If the canal is filled with tenacious mucus that will not readily come away, and if some induration of the surface exists, the first polar action indicated is the *negative*, to prepare the tissues for the essential action of the positive pole. The technique of dealing with these states which require negative electrolysis is described in other sections.

So many pelvic diseases embody several complications, each of which can always be treated from a single description of the technique, that it is not necessary to repeat every detail under each heading in these chapters. The basic principles which guide the physician in the uses of electric currents are exceedingly simple and require scarcely more than the possession of good apparatus and a little clinical practice, in addition to ordinary medical training.

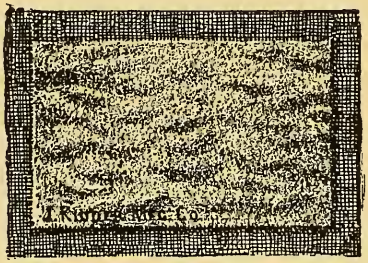


Fig. 115. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

As soon as the surface is clean, relaxed and prepared by the negative current, proceed to apply the *positive* current in about the same manner, except that a platinum electrode must be used. Employ the usual felt-covered, flat electrode upon the abdomen and connect it now with the negative pole of the galvanic battery. Insert the speculum and cleanse the parts with the usual creolin or carbolic solution. Sterilize the plati-

Fig. 116. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

num electrode with the alcohol flame, connect it with the *positive pole* and insert it to the requisite depth of the diseased canal.

Increase the constant galvanic current through the rheostat from zero up to the point of comfortable uterine tolerance and after five or eight minutes reduce gradually to zero. While the dosage at first may be only 25 mil. it will speedily increase to 50 mil., but higher amperage than this will rarely be required, for a caustic and alterative action is needed rather than the cauterization of large currents. If, however, the particular case presents exceptional conditions, the experienced operator who knows the effects he seeks will push his dosage until he gets the effects, however obstinate and chronic the case may be.

The uses of antiseptic and astringent or depleting tampons, the auxiliary aid of bipolar faradization and other rational measures for the benefit of the patient will suggest themselves to the physician, and should be employed as needed during the course of treatment. The remedy in chief is the galvanic current.

Chronic Uterine Hyperplasia, with Uterus Large, Soft, Œdematous, Sensitive to Pressure and Easily Bleeding.— Begin treatment with vaginal bipolar faradization every second day. Daily sittings during the first week of treatment are better still. Switch into circuit the rapid vibrator, four or five

cells and the 1,500 yard No. 36 coil, and with the aid of the rheostat increase the current strength from zero up to the

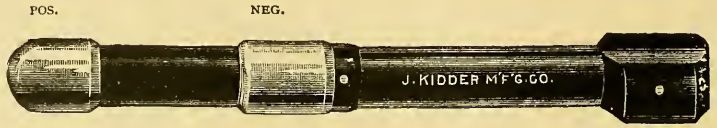


Fig. 117. Bipolar vaginal electrode.

point of producing a gentle grasp upon the tissues, accompanied by an increasing sense of comfort. No matter what coil or E. M. F. produces this effect, the current must be increased from zero until the correct dosage is found.

Continue these applications with a gradually increasing stimulus to absorption and contraction as rapidly as sedation prepares the parts.

Either at the beginning if it is necessary, or at any other time it may be required in any given case, free drainage may be assisted by a few applications of intra-uterine negative electrolysis, with mild currents of from 15 to 30 mil.

The *direct indication* for the *general condition* of the uterus is the anti-congestive, alterative, astringent, muscle-strengthening action of the *positive* galvanic current. The galvanic part of the treatment may be begun as soon as the vaginal bipolar method accomplishes its work of preparation of the parts by removing tenderness and irritability.

Place the usual large felt-covered, flat electrode, 7 × 10, upon

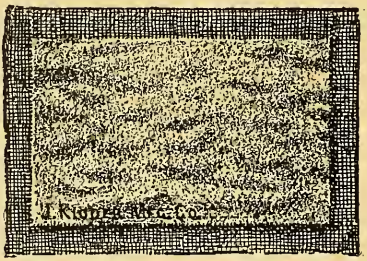


Fig. 118. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

the abdomen and connect it with the negative pole. Burn off the surface of the positive platinum or pure tin electrode with

Fig. 119. Long tin tip intra-uterine electrode.

the alcohol flame in the usual manner, and insert it so that metallic contract will be made with the entire uterine canal, from the external Os to the fundus.

Gradually increase the current strength through the rheostat, from zero up to the point of comfortable tolerance, which may be between twenty and forty mil., in the early treatment of the case.

These milder applications may be made twice a week, followed, as usual, with five or eight minutes of supplementary bipolar faradization with currents which become increasingly tonic with the progress of improvement.

After improvement permits the use of 50 mil. with the intra-uterine electrode, the conducting area of the external electrode should be increased in the usual way, by placing a pad upon both the abdomen and sacrum .and connecting them to the negative pole with a bifurcated cord.

The intra-uterine current should now be pushed as rapidly

Fig. 120. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

as possible up to about 100 mil. Maintain the maximum dose for three or five minutes during each sitting and reduce gradu-

ally to zero. Insert a glycerine tampon after treatment and also dust the skin beneath the external electrode with toilet powder, to remove any temporary irritation.

Repeat these applications of doses above 50 mil. only once in from four to six days, allowing the effect of each to fully mature before the repetition. Inter-current treatment should be *bipolar faradization.*

After absorption of the excess of fluids in the tissues by the combined action of the osmotic, cataphoric and electrolytic properties of the positive galvanic current, the vigorous and stimulating vaginal bipolar faradic application, which will now be safely tolerated, will aid to shrink down the uterus and impart tonicity to its own muscular fibres and supporting structures. The patient will rapidly improve. The galvanic current lightens and reduces the uterus and the coil-current tones up the muscular supports.

Chronic Uterine Hyperplasia, with Induration. — For this obstinate condition persistent intra-uterine negative electrolysis and vaginal bipolar faradization are indicated as the chief measures.

Commence treatment with the usual vaginal bipolar test of

Fig. 121. Bipolar vaginal electrode.

the tolerance of the tissues to allay irritability, tenderness and congestion, and establish the composure of the patient. The indications for the regular, systematic use of this method with gradually increasing dosage are the same as usual, and the reader is now familiar with them.

After the routine preliminary preparation of the parts for

intra-uterine applications the *first galvanic sitting should always employ the positive pole.* I believe this to be a judicious rule for the general practitioner to follow, because of the advantages which the action of this pole affords in determining the state of the uterine and adjoining tissues and in preparing tolerance.

If the first application demonstrates a normal tolerance we may begin at once at the next sitting with the essential softening, liquefying and absorbing action of the *negative* pole. If intolerance to more than a small current demonstrates subacute inflammation which must be allayed before taking the next step, the treatment of this complication by measures described under a separate heading must precede active electrolysis. (See PELVIC PERI and PARA METRITIS.)

The judgment obtained by a little practice with these methods instructs the physician when he can safely proceed to attack the indurated hyperplasia.

Place large felt-covered, flat electrodes, 7 × 10 (well saturated

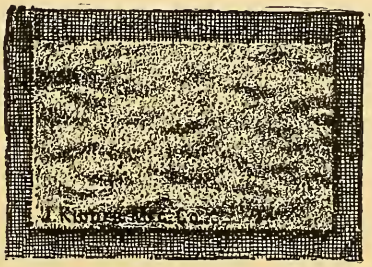


Fig. 122. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

with the invariable hot-water solution of bicarbonate of soda), upon the lower abdomen and under the sacrum and connect

Fig. 123. Long tin tip intra-uterine electrode.

Fig. 124. Positive electrode with sliding shuttle.

them to the positive pole of the galvanic apparatus. As the negative galvanic current does not attack metals, the intra-uterine electrode-sound may be selected solely with reference to suiting the size of the canal. The metallic part should make thorough contact from the external Os to the fundus if the cervical tissues are diseased.

Increase the constant galvanic current through the rheostat from zero up to the point of the greatest uterine tolerance which can be secured at each sitting, until this advances to about 100 mil. Maintain the maximum current for three to five minutes, and reduce the current gradually to zero. It is a good rule to at once devote five minutes to a vaginal bipolar application and close the sitting with a glycerine tampon.

Prescribe other internal and hygienic measures indicated by the condition of the patient, and in chronic uterine diseases do not expect electricity to do the entire work unaided by other medical resources, although in a clinic where no prescribing is allowed, the average results of electrical treatment are surprisingly good.

Catarrhal Metritis, with Extension to the Tubes and Ovaries.—The principles governing the treatment of these cases follow the familiar indications for the choice of current and polarity already described in these pages. If the affection exists, as it often does, in the stages prior to constitutional involvement, local applications will be sufficient. The patient whose general health has not yet suffered very seriously will obtain satisfactory improvement under purely local methods.

But when the physical organization has suffered and the local symptoms are accompanied by nervous disturbances and profound depression, it is necessary to treat the patient as well as the disease. Here it is that the static machine becomes of

the utmost importance to the gynecologist. It requires but a few moments to treat the uterine canal with the galvanic current, but to pursue and conquer the array of symptoms and migratory disorders which some of these cases present with the localized electrodes of galvanic and faradic methods is not a practical task. The rest cure is futile as a therapeutic measure, and surgery and drugs alike disappoint.

The local methods described in these chapters and reinforced by the resources of static electricity will generally yield results in these cases "without a parallel in any other remedy. Cases due to puerperal infection, even though of some years' standing, will respond quickly. Gonorrhœal cases are slower if seen in late stages, particularly if there be extension to the tubes; in these a symptomatic cure will often be marred by the continuance of the leucorrhœa for some time."

In all these cases with extension to the tubes and ovaries the degree of intensity of the salpingitis guides us to either an entire reliance at first upon the vaginal methods—both of the galvanic and induction coil currents—or directs the conservative intra-uterine applications until improvement progresses and tolerance becomes established, so that a more active dosage can be employed.

Gonorrhœal Metritis.—One of the most instructive medical books that could be written would apply the "parallel column" method of modern journalism to electro-therapeutics and therapeutics not electrical. It is suggestive to compare positive galvanism or *metallic electrolysis* with the permanganate douches, the methylene blue paint, the ice-water coil, the leeches and opiates, the nitrate of silver, the laminaria tents, the uterine packing, and finally the excision of the mucous membrane and destruction of Skene's and Bartholin's glands which a prominent medical journal of Jan. 25, 1897, places as follows before its readers:

Diagnosis and Treatment of Gonorrhœal Metritis.—The diagnosis of gonorrhœal metritis can be made by digital examination and the speculum. The chief signs for differentiat-

ing it from other forms are the normal appearance of the cervix and the smallness of the external os.

Gonorrhœa being a local infection, all intra-uterine manipulations are contra-indicated, such as passing sounds, dilating and washing with antiseptic solutions. Above all, the curette is the most dangerous therapeutic procedure. It opens the way for absorption of the gonococci into deeper structures and is often followed by rise of temperature, pain in the lower abdomen, and may go on to a true peritonitis or infection of the joints.

In acute cases, when only the cervix is involved, the patient should be put to bed, given warm douches of permanganate of potash twice a day, and the interior of the cervix painted over gently with methylene blue, care being taken not to pass the internal os. If the uterus is involved, the patient should be put to bed, an ice-water coil applied to the abdomen, and douches of mild antiseptics given. The pain may be relieved by leeches applied to the perineum and opiates by the mouth.

After the acute symptoms have subsided, the cervix may be touched with nitrate of silver and vaginal tampons inserted. If the uterine cavity is involved, the cervix should be dilated widely with laminaria tents and the cavity of the uterus packed with gauze dipped in glycerine and creosote or naphthol-camphor. Cases of inveterate endocervicitis require excision of the mucous membrane. At the same time the foci of infection in the urethra, Skene's glands and Bartholin's glands should be destroyed.

CHAPTER XXII.

TREATMENT OF SOME OF THE LESIONS OF THE CERVIX.

Neglected minor lacerations of the cervix. Erosion of the cervix. Ulcerations and non-malignant degenerations of the cervix. Stenosis of the internal Os. Clinical case. To soften the indurated angle of a sharp uterine flexion.

Neglected Minor Lacerations of the Cervix.—*Galvanic.*—Many reflex nervous symptoms and local morbid states have been attributed in the past to neglected lacerations.

Surgical repair does not always relieve the symptoms, and in a great many cases the lesion in its chronic stage seems too insignificant to warrant any attempt to operate.

All these minor scar tissues (which cannot be certainly improved by an operation or excision) can be satisfactorily softened and the symptoms relieved by negative electrolysis employed in the following manner :

Place a felt-covered flat electrode, 7×10, upon the abdomen

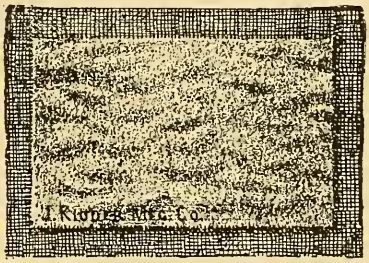


Fig. 124*a*. Fine felt or sponge-covered electrode—assorted sizes with soft rubber insulating backs.

and connect it with the positive galvanic pole. Insert a speculum and swab out the vagina with the usual creolin or

carbolic solution. Connect with the *negative* pole one of the set of metallic tips or olives which will fit best in contact with the

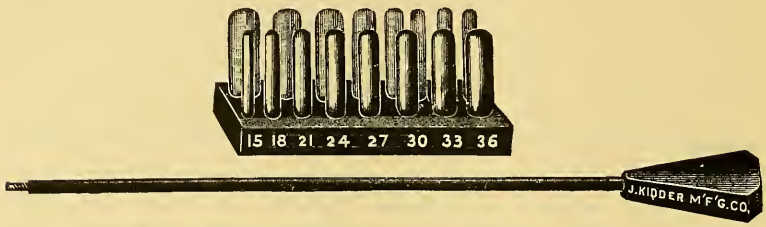


Fig. 125. Zinc and copper tips for metallic electrolysis.

scar. Hold it steadily against the cicatrix and increase the constant galvanic current through the rheostat from zero up to ten or fifteen mil. according to the size of the metallic tip employed. The larger the tip the more current can be used.

Maintain the softening and healing action for about ten minutes and reduce the current gradually to zero.

With the speculum still in place pack a protecting cotton tampon soaked in a solution of soda-bicarbonate under and around the cervix leaving the cicatrix exposed. Spread apart the lips of the laceration. Have at hand a small bottle of nitric acid C. P. diluted with nine parts of water, making a ten per cent acid strength. With a hardwood stick such as watchmakers use, or a glass rod, apply the dilute nitric acid to the lacerated surface which has just been electrolyzed. As soon as a film forms neutralize the acid at once with soda-bicarbonate solution and not only swab the cicatrix to arrest the action of the acid but use care to avoid letting any of the acid run down upon the other tissues and burn them. Remove the tampon at close.

Repeat this application about once a week between menstrual periods. In a few months it restores the tissues to practically normal in cases which are not too difficult to treat by this method. It also successfully corrects cases which appear to be incipient epithelioma. The patient with irritating scar tissue of the cervix procures a normal cervix and thus far

restored health by this method. Associated conditions must also receive due attention as well as the general health.

Erosion of the Cervix around the External Os.—*Galvanic.*—Negative galvanic applications are followed by rapid healing of the surface in practically all simple cases. The condition usually exists with associated lesions which also require treatment, and the application to the erosion constitutes only a part of the regular sitting.

With the usual felt-covered flat electrode, 7×10, upon the abdomen or sacrum and connected with the positive pole, select a large size blunt tip from any one of the sets employed for metallic electrolysis. Whether the metal is copper or zinc is

Fig. 126. Short copper or zinc bulbs.

of no moment, for it is not affected by the current and is selected only with regard to convenient size and shape. Connect it with the negative pole and place the blunt metal end against the eroded tissue. Increase the constant galvanic current through the rheostat from zero up to about 15 mil., maintain for three or five minutes, slowly moving the electrode over all the denuded part, and reduce to zero. Repeat again at the next sitting and as the surface gradually heals make the application only to the parts which still remain unhealthy.

If the tissues are thickened and tough, and present excessive granulations, these must be cut down by a few applications of the same method with the dose increased to 25 or 30 mil. In all cases the physician has only to look at the surface to know exactly what the application should be. Repeat until healthy tissue is established.

A variation of the galvanic method employs the hydro-electric douche electrode.

Douche.—Moisten a felt-covered, flat electrode, 7 × 10, in a one per cent. hot water bicarbonate of soda solution and apply it upon the abdomen with the patient in the dorsal position on the operating table. Connect this with the positive galvanic pole.

Prepare about three quarts of any preferred alkaline and antiseptic solution in the irrigating jar, placed at a sufficient height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal electrode and connect the electrode with the negative galvanic pole. Have the water

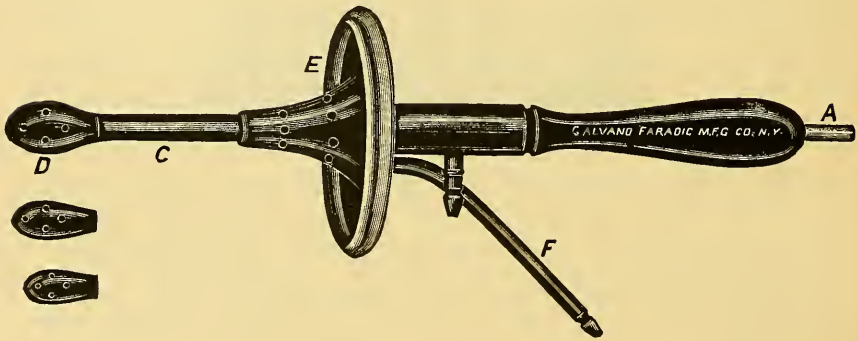


Fig. 127. Electrode for vaginal hydro-electric applications.

hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Immediately regulate the constant galvanic current from zero up to tolerance, and maintain the current until the irrigator is empty or for fifteen or more minutes.

Ulcerations and Non-malignant Degeneration of the Cervix.—*Galvanic.*—Place the usual felt-covered, flat electrode, 6 × 9, upon the abdomen or under the sacrum. If any cysts or hard nodules are discovered upon inspection of the tissues through the speculum connect a lance-pointed large needle

with the negative pole and plunge it into the cyst about an eighth or quarter of an inch. Switch into action the constant

Fig. 128.

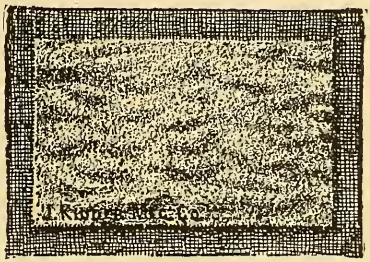


Fig. 129. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

current and pass about 7 mil. until a white froth bubbles out around the electrode and the nodule is destroyed.

Repeat process upon each nucleus that exists. The patient is almost unaware of the process as it is perfectly painless and consumes scarcely more than a minute for each puncture. On withdrawing the needle the tissues close and heal so readily that on the next examination a few days later there will usually be no trace left.

Treat each ulcerated patch with negative electrolysis to promote nutrition and healthy granulation. If the ulcer is just commencing puncture it and treat as directed above. If the tissues are already broken down and form an ulcerated patch apply the negative current through the blunt tip of the largest of the set of copper or zinc electrodes in the same manner as directed for erosions of the cervix.

If the tissues are soft and irritable, bleed easily, and present these familiar indications for the positive pole select the largest copper tip and place it against the tissues with the negative

pole now connected with the electrode on the abdomen or sacrum. Increase the constant current through the rheostat from zero up to about 15 mil. or the point of comfortable tolerance. Keep the copper tip in close contact with the tissues but prevent adhesion by very gentle rotation over the parts until every portion is attacked by the oxychloride of copper deposit. After eight or ten minutes close the sitting with no other similar treatment for a week.

At the next examination observe the effect of the cupric electrolysis and repeat with such modification as the tissues indicate. As soon as the tissues appear to be ready to take on healthy granulation cease the metallic electrolysis and with the same electrode freshly polished and connected with the negative galvanic pole encourage healthy nutrition by mild applications of ten or fifteen mil., about twice a week.

Stenosis of the Internal Os.—*Galvanic.*—To dilate a narrow or constricted Os producing irritation, or preventing uterine drainage, we have an all-sufficient remedy in negative galvanic electrolysis with mild currents. This condition was at one time supposed to be a prolific cause of dysmenorrhœa and mechanical dilators were frequently employed to tear apart the fibres. The results of mechanical dilatation were as unsatisfactory as they deserved to be, for the method is barbarous and needless.

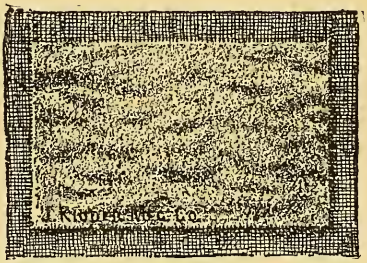


Fig. 130. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Place a *positive* felt-covered, flat electrode, 6×9, either under the sacrum or upon the lower abdomen and maintain it in firm contact. To the *negative* terminal of the galvanic battery connect either a uterine electrode-sound of medium size, or employ one of the assorted olives which are made for this purpose.

Fig. 131. Intra-uterine electrode—assorted size tips.

After engaging the cervix with the speculum and cleansing the parts insert the tip of the negative electrode gently into the canal as far as it will go without pressure. Support it in this position and slowly increase the current through the rheostat up to 5, 7 or 10 mil., spending at least five or eight minutes in the process if the olive does not pass the obstruction in less time.

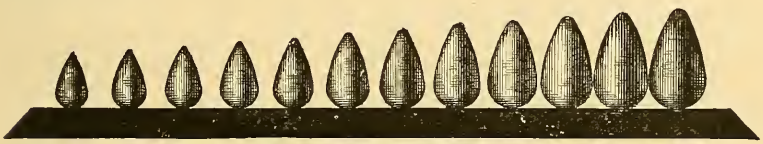


Fig. 132. Set of olive tips.

Handle for same.

When dilatation has been accomplished the electrode will glide into the canal as if drawn forward by suction. It requires no pressure and the electrode should simply be directed and supported.

Having begun with a small olive repeat the application with

a larger size at intervals of a couple of days until the result desired is accomplished. *The dilatation is accomplished with ease to the operator and without sensation to the patient.* It is usually *permanent* or becomes so during the course of treatment. If a repetition of the process is ever required at some future time it is as simple as at first.

While mechanical dilatation has been severely condemned, both by its failure to benefit the patient and by the judgment of judicious physicians, the advantages of negative electrolysis over tents, dilators and the knife are:

1. The process is painless, harmless, unaccompanied by shock, and is the acme of simplicity.

2. It represents the least possible trouble to physician and patient.

3. There is no destruction of the endo-cervical mucosa, or rupture of muscular fibres, and therefore no subsequent cicatricial contraction.

4. It is not followed by disturbing sequelæ, for *it is so gentle a process that the patient is not even aware from her sensations that it is being done.*

5. There is no liability of sepsis, for there is no injury to the tissues.

6. It does not require the patient to spend a moment in bed and the treatment is actually tonic in its nature.

7. The result is satisfactory, physiological and permanent.

Suppression of Menses.—On March 11 of this year Miss B. B., aged 20, consulted me at my office. Her menses had ceased suddenly two years before and had not returned, but she had had instead, about once a month, a slight, thin, leucorrhœal discharge, preceded by such feelings as she had previously experienced at time of natural menstruation. She was emaciated, weak and anæmic, but had no evidence of lung disease.

She had been treated by two gynecolgists who had dilated the uterine cervix and had given her emmenagogues and tonics. Upon examination I found such stenosis of the cervical canal that it was with extreme difficulty that I passed the smallest uterine sound. The uterus was normal as to length and position. I was unable to pass the smallest elec-

trical sound, so again passed the uterine sound through the canal and connected it with the negative cord, and placed the positive electrode in the patient's hands, and turned on a current of 15 mil., and a bloody froth of hydrogen gas mixed with a little blood oozed out as usual from the Os.

I moved the sound backward and forward constantly during the *séance* of ten minutes and at the close it passed easily. The current was turned on and off slowly, and the patient felt no shock but experienced a slight burning sensation at her hands and some slight abdominal pain, at the close of the *séance* complained of backache.

It was nearly time for her monthly leucorrhœal period. A week later she called and informed me that two days after the treatment her courses came on freely and naturally and that she felt much better. Three days prior to her April period I gave her another electrical treatment like the first, except that I used a larger sound, and except that the current used was much weaker, only 8 mil. eight minutes. A week later she called again and said her menses came on time and quite naturally. The stenosis of the canal had evidently been permanently relieved; she had some color; had gained in weight; was stronger and felt quite well. She has since remained well. (*Woolsey.*)

To Soften the Indurated Angle of a Sharp Uterine Flexion.—*Galvanic.*—For the purpose of establishing drainage or inserting an electrode to the fundus for intra-uterine treatment it is sometimes necessary to remove a barrier to free entrance to the canal.

This is often accomplished with the aid of the softening and absorbing action of the *negative* galvanic current. The technique of the method is exactly the same as that for *stenosis of the Os* described above. The dosage, however, will often require increase.

If unable to pass the electrode fully into the uterus at either the first or second sitting with an amperage of about ten mil., continued for eight minutes, a more active electrolytic softening will be secured by increasing the current for a brief interval up to 20 or 25 mil., if tolerance permits. Little or no pressure should be exerted upon the electrode as the action of the current carries it into the uterus almost as if by suction

when sufficient softening has taken place. The desired result is very speedily obtained in average cases, but it is the rule to persevere until the electrode enters the canal. *This procedure is as safe and simple as it is clinically valuable.* It will often aid the introduction of an electrode into tortuous canals, although there will be met some cases that cannot be entered by any manipulation. Unless such women have grave disease, however, they improve under electrical treatment and often obtain as complete a symptomatic cure as if the canal was open to the fundus.

CHAPTER XXIII.

TREATMENT OF OVARIAN LESIONS AND OTHER PELVIC DERANGEMENTS.

Congested and prolapsed ovary. Ovaritis. Reflex pain in the breasts. Pelvic pains. Obscure uterine derangements. Ovarian neuralgias. Pelvic pain dependent upon disordered innervation. Ovarian irritation and menstrual irregularity in young women without evidence of local disease. Post-operative pelvic pain. Post-operative electrical treatment.

Congested and Prolapsed Ovary.—When the ovary is enlarged, heavy and extremely sensitive to the slightest pressure and drags below its proper level, the temporary aggravation may be at once relieved by bipolar faradic sedation.

Connect the tip of the vaginal bipolar electrode with the positive pole of the improved high-tension induction coil

Fig. 133. Bipolar electrode.

apparatus and the inner half of the electrode to the negative pole. Warm and lubricate the surface with a little plain vaseline and insert it deeply into the cavity so that the tip is directed against the point of greatest tenderness. Retain it with gentle pressure in this position.

Switch 1,500 yards of No. 36 wire coil, the finely adjusted rapid vibrator and four cells into circuit. Start the current into action and increase it from zero through the secondary rheostat until it is perceptibly felt by the patient. Cautiously and gradually increase the current for at least ten minutes,

following up every abatement of tenderness with an increase in E. M. F.

After about ten minutes maintain the current evenly at the maximum dose for five minutes more, during which time it will become less and less perceptible as sedation is established. Gradually reduce the current to zero after a total sitting of twenty minutes. Insert a carbolic and glycerin tampon to support the ovary after withdrawing the electrode. If the condition is merely an acute aggravation a few daily treatments of this kind will be sufficient.

If it is a more chronic case the immediate relief will be prompt and effective, but to establish improvement, reduce the enlargement and tone up the supports will require more persistent applications, but the method is the same.

Ovaritis.—Whether this condition is acute or chronic, whether the ovary is simply congested or is enlarged, sensitive and prolapsed, causing severe dysmenorrhœa, an efficient treatment is often bipolar faradic sedation.

Faradic.—Warm and lubricate the bipolar electrode with plain vaseline, connect the tip invariably with the positive pole of the

Fig. 134. Bipolar vaginal electrode.

high-tension induction coil apparatus, connect the inner half with the negative pole and insert it deeply into the vaginal cul-de-sac.

Switch the 1,500 yard No. 36 wire coil, the rapid vibrator and four cells into circuit, and with the current strength regulated through the rheostat to the point of agreeable comfort hold the tip of the electrode successively against each point of extreme tenderness detected by shifting the electrode very carefully from side to side.

Maintain the action of the current until absolute sedation is obtained and the patient is left without the slightest pain. Reduce the current to zero before withdrawing the electrode

and close the sitting by inserting a carbolic and glycerine tampon if it can be tolerated.

Repeat bipolar sedation for twenty minutes daily until the relief of pain lasts more than one day. Then repeat every second day and proceed from the No. 36 coil to No. 32 coil with increased current strength as rapidly as improvement creates a healthy toleration.

After full sedation is secured supplement bipolar faradization with the positive galvanic current, if the individual case required its aid.

Galvanic.—Place a felt-covered, flat electrode, 6×9, saturated with the usual warm solution of bicarbonate of soda, upon the lower abdomen over the ovary and connect it with the negative

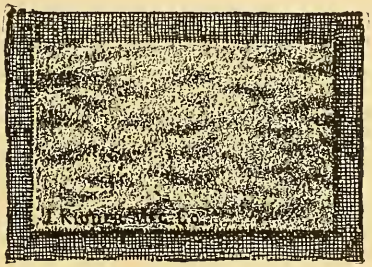


Fig. 135. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

pole of the galvanic switchboard. Connect with the positive pole the carbon ball electrode and wrap it with as large a mass

Fig. 136. Carbon ball electrode.

of absorbent cotton as will comfortably enter the cavity. Moisten it in the warm bicarbonate of soda solution and do not press the cotton any drier than is needed to avoid dripping.

The more moisture it contains the better. Either with or without a speculum insert the ball electrode into the vagina and support it gently against the inflamed ovary.

Increase the constant galvanic current from zero up to 15 or 20 mil. at the first sitting. Maintain for about ten minutes and reduce gradually to zero. At later sittings the amperage may be increased gradually to 30 and 40 mil., as improvement advances, and the increase in the tolerance of the tissues is the measure of the benefit derived. After withdrawing the electrode insert a carbolic and glycerin tampon.

Repeat applications three times a week between menstrual periods.

If the case is an old one with adhesions and cold deposits the use of the negative galvanic current to soften and promote reabsorption should be combined with vigorous bipolar faradization. In these cases the positive current is not indicated. The management of technique is, however, precisely the same and employs the same electrodes.

Another useful method is the Hydro-electric Douche as described below:

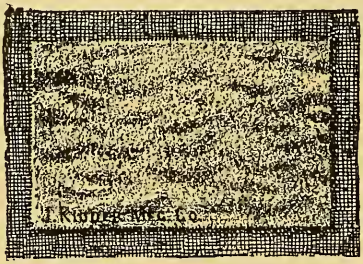


Fig. 137. Fine felt or sponge-covered electrode—assorted sizes with soft rubber insulating backs.

Galvanic Douche.—Moisten a felt-covered electrode, 7 × 10, in a one per cent. hot water bicarbonate of soda solution and apply it upon the abdomen with the patient in the dorsal posi-

tion on the operating table. Connect this with the positive galvanic pole.

Prepare about three quarts of any preferred alkaline or antiseptic solution in the irrigating jar placed at a sufficient height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal electrode and connect the electrode to the negative galvanic pole. Have the water hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Immediately increase the constant galvanic current fron zero up to 15 or 20 mil., and maintain the current until the irrigator is empty, or for fifteen or more minutes. Prescribe other measures indicated in each individual case, repeat the electrical application daily for a few days and three times a week until recovered.

Inflamed and Prolapsed Ovaries.—The principle of treating any grade of this condition from the acute stage to almost any state short of malignant degeneration follows the now familiar rules of applying faradic and galvanic currents to relieve pain, restore healthy nutrition and tonicity to muscular fibres.

The remedy of first importance is vaginal bipolar faradic

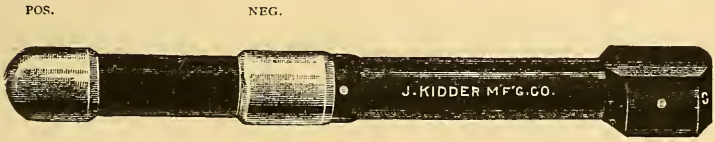


Fig. 138. Bipolar vaginal electrode.

sedation followed by a glycerine tampon when this can be comfortably employed. Repeat daily until sensitiveness to pressure has been subdued, then alternate the use of the galvanic current with the positive pole applied in the usual manner with the cotton-wrapped carbon ball electrode against the ovary.

Place the felt-covered negative electrode, about 6×9, under the sacrum or over the hypogastrium. Gradually increase the constant galvanic current from zero until it produces a mild

sensation to the patient or not over 20 mil. at the first sitting. After about eight or ten minutes reduce to zero and follow with the bipolar faradic sedation. Repeat three times a week.

Fig. 139. Carbon vaginal electrode with removable carbon tip.

The subsequent increase of the current strength will follow the usual course up to 40 or 50 mil.

When structural changes have occurred, the prognosis is affected rather than the method of treatment, the differences in the latter consisting chiefly in selecting the pole (either positive or negative) which conforms to the indications present. In one way or another almost all these cases, even those which have been sent by thousands to the operating table can be either entirely cured or given symptomatic relief by the persistent use of conservative electrical methods, and the number who will find no relief except by the removal of the diseased organs is so small that the physician in ordinary practice cannot compute the vanishing percentage.

In all cases regardless of theory the first indication is a trial of proper electrical methods. Not until long after other measures have failed should the uncertainties and risks of a radical operation be considered, and when an operation is regarded as necessary it is well to take into account that surgery also scores many failures to restore comfort to patients.

In the treatment of cases of this kind I place electricity first and other remedial measures after. It goes without saying that a displaced ovary, the same as any other displaced organ, *must* be held in position and made to stay at home. In these cases that I have reported when the ovary was prolapsed it was held in position by a wool tampon, and during the inter-

vals of the application of the galvanism it was still kept up. The surroundings and habits of the patient must not be lost sight of. Dancing, horseback riding, bicycle riding and pedestrian feats, which young ladies who go into the country are so fond of taking and boasting of, must be forbidden. (*Brown.*)

Reflex Pain in the Breasts.—The infra-mammary pains which uterine cases often complain of do not need a local application of an electric current, but generally disappear early in the course of the pelvic treatment. The aching tenderness which sometimes pervades the entire breasts of women whose uterus becomes congested and heavy is promptly relieved by vigorous vaginal bipolar faradization followed by a glycerine tampon. In chronic cases in which relapses occur from time to time a return for an occasional application suffices to maintain an average degree of comfort.

Pelvic Pains.—In the four chief methods of employing electricity in the treatment of pelvic conditions we possess the means of almost certainly relieving or curing any form of pain which is not associated with a condition which imperatively demands an operation, and these are very few. The failure of properly employed galvanic and high-tension induction coil currents according to the directions given in this book may therefore cause the operator to suspect a condition which is not amenable to conservative treatment.

In any case in which pain is a symptom the indications for proper electrical treatment will usually appear at sight upon making the ordinary examination. The appearance of the tissues adds very much to what may be learned from a digital examination and history, and explicit directions are so fully given in these chapters that the reader may turn from his diagnosis to the index of this book and almost certainly select at once the proper course to pursue.

It is important to acquire a knowledge of the order in which to attack parts of a complicated condition. Relieve the more acute states first, or those which operate as causes, and later dispose of the remaining lesions or symptoms.

Obscure Uterine Derangements.—For the comfort of the general practitioner who is gratified to be able to please his patient with a satisfactory cure even without a classical diagnosis it may be confidently stated that electricity offers valuable assistance in this way.

When reflex symptoms or symptoms referred directly to the pelvis point to some uterine cause which examination fails to detect, the physician may clear up the matter by a few treatments of percutaneous galvanism or bipolar faradization. If one or the other of these methods abates the symptom it should be continued until it completes its work. Attention to anæmia and the general health of the patient will reinforce the local application.

The symptomatic relief thus often secured to temporary sufferers through the aid of medical electricity is one of several potential arguments for its more general use.

Ovarian Neuralgias.—Over these pains of women electric currents exercise a sovereign and beneficent sway.

Faradic.—Warm and lubricate the improved bipolar vaginal

Fig. 140. Bipolar vaginal electrode.

electrode and insert it into the cavity so that the positive tip rests upon the site of the greatest tenderness. Support it with very gentle pressure during treatment. Pursue the method of bipolar faradic sedation, as fully described under that heading. (See INDEX.)

Repeat the application daily for a few days and when relief extends to longer intervals lengthen the time between the sittings accordingly. If relief becomes satisfactory and progressive continue the sittings three times a week until complete health is restored.

As the diagnosis of the cause of pain cannot always be made with certainty we may suspect some graver lesion of the ovary if improvement is not satisfactory and is not retarded by the patient's carelessness or by known complications.

In any event vaginal bipolar faradic sedation is the first remedy to employ for the relief of pain and the improvement of local nutrition. *Séances* three times a week between menstrual periods will in a short time give relief to an uncomplicated case. If the ovary is hyperæmic and drags heavily upon its supports the same method will give tone to the tissues, disperse the congestive engorgement and with the aid of a carbolic and glycerin tampon after the withdrawal of the electrode the patient will rapidly secure permanent comfort.

Galvanic.—If some occasional pain returns after a reason-

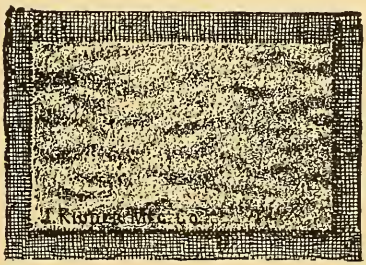


Fig. 141. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

able number of bipolar treatments place a felt-covered, flat electrode, 6 × 9, over the lower abdomen on the side affected and connect it with the negative pole of the galvanic switchboard.

Connect a cotton-wrapped, carbon ball electrode with the positive pole, moisten it in the invariable warm water solution of bicarbonate of soda and insert it in the vagina in contact with the sensitive organ.

Gradually increase the constant galvanic current from zero

up to about 20 mil., maintain this dosage for ten minutes and reduce to zero. Repeat three times a week. By the use of one or both of these methods many of the painful ovarian

Fig. 142. Carbon vaginal electrode with removable carbon tip.

disturbances may be treated with perfect confidence in the result. Unless a grave lesion is present to prevent its curative action there is nothing so practical and satisfactory in the whole range of medical gynecology as the action of high efficiency electrical currents in the treatment of neuroses and functional disturbances of the pelvic organs.

Pelvic Pain dependent upon Disordered Innervation.—In all neuralgias of the pelvis, whatever may be their nature or severity, the element of pain can almost infallibly be combatted by vaginal bipolar faradic sedation or by percutaneous galvanism.

Faradic.—Attach the positive pole of the high-tension induction coil apparatus to the tip of the electrode. Always

Fig. 143. A proper bipolar electrode.

make the other pole negative. Warm and lubricate the electrode with plain vaseline and insert it into the vagina as deeply as it will go. It may either be held in position by the operator or an assistant or by the patient herself by means of the author's bipolar electrode holder.

Select first the 1,500 yard No. 36 coil, the rapid vibrator and

four cells. After the electrode is in position start the current into action and increase it from zero by means of the rheostat until it is felt by the patient. Direct the tip of the electrode gently against each point of local tenderness that can be found and hold it steadily in place until the current, now carefully increased to full tolerance, dies apparently away under the sedative action. After complete sedation of all points of tenderness is effected reduce the current gradually to zero and withdraw the electrode.

Take plenty of time, twenty minutes or even longer if necessary, to produce complete sedation at the first sitting. As soon as improvement advances so that the 36 coil is no longer strongly felt switch the 800 yard No. 32 coil into circuit and continue the same method until normal painlessness is restored.

Sittings may be repeated daily for the first week and afterwards three times a week between menstrual periods.

Improvement is usually so rapid and satisfactory that if good results are not speedily obtained some graver cause of the pain must be suspected, sought, found and subjected to appropriate treatment.

Never let a bipolar electrode slip out of the cavity and come in contact with the vulvar tissues while any form of induction coil current is passing. The shock to the patient would be a lesson never to be forgotten, and should be avoided by simple care.

Galvanic.—Place the positive felt-covered electrode over the ovary and the negative under the sacrum. Pass a constant galvanic current of about 20 mil. at first, gradually increased to 30 or 40 mil. Duration of sitting 15 minutes, three times a week. It is well often to alternate the bipolar and galvanic methods.

Ovarian Irritation and Menstrual Irregularity in Young Women without Evidence of Local Disease.—Vaginal bipolar faradization will control the irritability, tranquillize the general nervous system, promote a healthy state of the tissues, and do

these cases more good than any other single remedy in therapeutics. It should be regulated to the dose of agreeable tolerance and repeated daily for the first week. After improvement is progressing repeat three times a week between periods for two or three months.

For the proper selection of current strength and management of the technique see section describing *bipolar faradization.*

The percutaneous galvanic method is also a valuable remedy.

Post-Operative Pelvic Pains.—When these can be attributed to a traumatic neuritis, or neuralgia, or pelvic congestion, or exudation, the immediate and persistent use of vaginal bipolar faradic sedation should be added to any other measures for relief. It is peculiarly suited to cases of this kind.

The hydro-electric rectal douche application also presents special advantages when the action of the bowels remains arrested after a laparotomy. The technique of this administration is fully described under other headings.

The remarkable power possessed by the high-tension induction coil current to relieve and even remove neuralgic pain has been doubted by many (who have never tested high efficiency apparatus) but to me there is nothing more certain. I recall at this moment many cases of pain in the pelvis continuing long after the operation for the removal of the ovaries which the operation had failed to cure, and which was more or less promptly cured by prolonged application of the rapidly interrupted coil current to the inside of, or to the neighborhood of the uterus with the bipolar intra-uterine or vaginal electrode. In like manner I have entirely cured without operation the neuralgic pains of other patients for whom abdominal section had been advised by my colleagues and even formerly by myself. Certain it is, however, that only very rapid interruptions possess this anæsthetic effect. (*Smith.*)

When we consider the immense force of *pain* as an argument to induce patients to submit to operations for its relief and the marked influence of galvanic currents, high-tension induction coil currents and static electricity, over so many pains of obscure origin, it must be regarded as little short of

malpractice to operate without other reason. The atmosphere surrounding the surgeon in his hospital and clinical work is partly made up of fictitious confidence in the beneficial result he produces and actual ignorance of the benefits which are readily obtained by conservative methods.

The after-histories of thousands of patients who figure as recovered in surgical tables are far more familiar to the family physician into whose hands they come for succeeding treatment than to the specialist and operator out of whose hands they usually pass in a few weeks; often glad to escape with their lives and concealing ailments in order to escape.

With the gradual introduction of improved electrical apparatus into the offices of an increasing number of practitioners there is a gradual *decrease* in the number of patients who must be urged to seek that last resort of desperate cases, the operating table.

Post-Operative Electrical Treatment.—In an interesting case reported by Dr. Flinn the patient presented a great variety of distressing symptoms which remained unrelieved after six months of medical treatment, eight months of electrical treatment repeated twice a week, and a surgical operation.

When the laparotomy was performed, the left ovary was normal, but there was found a fibroid cyst of the right ovary the size of a small Brazil nut. The ovary and several small cysts in the same region were removed. Adhesion of the uterus was broken up, ventral fixation done, and a stricture of the rectum was dilated.

Following the operation there was no improvement in the dysmenorrhœa, the right limb was nearly useless, appetite poor, bowels constipated, the severe pains within the abdomen remained and she had no sleep without drugs. There was no special improvement resulting from the operation. Electrical treatment was again resumed and this time with a general amelioration of all the symptoms which in a month and a half became so marked as to warrant an entirely favorable prognosis.

Others have reported similar cases and have had the experience of treating patients after operations and having them im-

prove. It is not uncommon to treat cases apparently without benefit, have them fail to receive benefit from an operation, and finally have them treated *again* with electricity with most decided improvement. In many of these cases the explanation of the apparent anomaly is simple, for after the exciting cause has been removed by the operation and nature has not corrected the remaining functional derangement, electricity takes the patient in hand, increases the nutrition, relieves the pain, stimulates the nerve supply, and produces the desired symptomatic cure. These results illustrate the inter-dependence and friendly relation of electric currents and the surgeon's knife. The utility of electro-therapeutics as an adjunct to the work of the pelvic surgeon cannot be too thoroughly appreciated by all who look singly to the patient's welfare, for at the point at which cutting and suturing stops, and leaves the rest to nature, the tonic and nutritional action of electricity steps in and, in the suggestive words of Cavallo written more than one hundred years ago, "*aids the innate endeavor of nature to restore the sound state.*"

CHAPTER XXIV.

TREATMENT OF PELVIC INFLAMMATION.

Pelvic peritonitis in acute stage. Clinical cases. Chronic peri-metritis and inflammatory exudations. Clinical remarks. Acute catarrhal endo-salpingitis; subacute; chronic. The treatment of catarrhal salpingitis. The treatment of suppurative salpingitis. Abscess of fallopian tube. Remarks upon suppurative peri-uterine inflammations. Pelvic hæmatoma and hæmotocele.

Pelvic Peritonitis in Acute Stage.—The damage done to a woman's health by peri-uterine inflammations may render her a lifelong sufferer, hence the importance of effective treatment to allay inflammation and prevent the formation of pus is very great. According to Sexton: "The first indication is to relieve pain, and in most instances this can best be done by the early administration of saline purgatives. Epsom salts in saturated solution is the first and quickest method. It empties the bowels, abstracts moisture from the tissues, drains the engorged pelvic vessels and diminishes the blood supply to the inflamed parts. Glycerine into the rectum next supplements the relief of pain by similar osmosis. When medical treatment has reduced the local pain and tenderness we can apply loose tampons of glycerine over the irregular masses that can be felt under the fingers."

When, however, the local tenderness will not permit a finger to be inserted for an examination, and in the onset of the attack, at the very first call of the physician, as soon as he has prescribed any measures whatever, a warm and lubricated vaginal bipolar electrode may be gently passed into the vagina and supported so that no sense of weight is felt by the patient.

From the moment the carefully regulated soothing current pours into the parts the arrest of pain and the inflammatory

process begins, and if the application is early enough, resolution without suppuration is almost assured. In a manual upon gynecology to which I have elsewhere referred, and which recommends mild faradization for acute inflammations within the pelvis, it is stated that "the most convenient faradic battery to employ is one in which the primary current is generated by single dry cell"!!

In endeavoring to obtain clinical results in acute inflammations, all such inferior apparatus, whether cheap or costly, must be abandoned. To employ such a battery as quoted above is positive malpractice. The high-tension induction coil current is a *sine qua non*, and I know of but one pattern of bipolar electrode that is proper to use. So accustomed are physicians to regard their faradic batteries from the single standpoint of price that unless the practitioner has got beyond this rudimentary point in his training in electro-therapeutics and can distinguish between the finer shadings and qualities of different rapid vibrators and different coils he cannot safely employ the sovereign remedy urgently demanded in the acute stage of pelvic inflammation. Magnificent as are the results to the patient produced by true bipolar sedation the calamities of disease alone have fresh horrors added to them at the mere thought of treatment by the family faradic battery.

In common with other physicians who still remain strangers to the finer therapeutics of high-tension coils Sexton fails to mention the sheet anchor of treatment in acute pelvic inflammation but proceeds: "After the tenderness has grown less and after a few days have elapsed the negative galvanic current may be applied, not over 20 mil. repeated every second day. The effect upon the pain, of this application, is not infrequently simply wonderful. The swelling diminishes; under its influence I have certainly seen lumps, masses,—hard tender masses—in the broad ligaments disappear, the uterus become movable and the hardness of the vaginal vault disappear."

In hastening resolution, in quickly reducing the inflammatory tenderness and preparing the patient for the second (galvanic)

stage of treatment which deals with the removal and reabsorption of exudates we have no other remedy like *bipolar faradic sedation.*

Take to the bedside the portable high-tension induction coil apparatus, a pair of conducting cords and bipolar electrode.

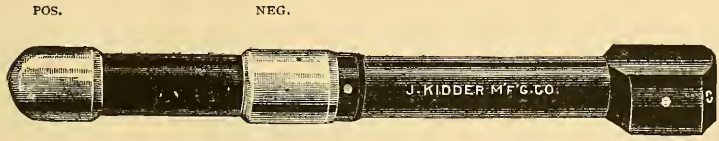


Fig. 144. Bipolar vaginal electrode.

Connect the cord from the positive pole to the tip of the electrode and the negative pole to the inner half. Warm the electrode to blood heat, lubricate it with a little plain vaseline and with scarcely any disturbance to the patient it can be inserted to the posterior cul de sac of the vagina by the physician, or attendant nurse, or by the patient herself.

No speculum is employed and no preparation or douche of any kind is necessary. The patient remains recumbent on her back, the electrode is carried under the coverings, inserted into position and retained there in the simplest possible manner.

During the first application an attendant should hold the thumb against the external end of the electrode to guard it from slipping out, but as soon as the patient becomes composed she can keep it in position without further help by the pressure of her own limbs.

There is neither hurt nor shock of any kind to the application. Switch four cells, the rapid vibrator and 2,000 yards of fine coil into the circuit with the current at zero and controlled through the secondary rheostat. With the vibrator in smooth and even action gradually increase the current strength until the patient perceives a sense of comfortable grasp upon the tissues. After five minutes enough sedation will be accomplished to lessen the tenderness so that the current strength becomes less perceptible. Increase it slightly again up to the

point of agreeable tolerance and maintain it evenly until sensation again diminishes.

If the current from 2,000 yards of fine coil ceases to be sufficient with an E. M. F. of four cells it is not wise to switch the fifth or sixth cell of the apparatus into circuit as the intense deflagration of the spark between the platinum tip and the surface of the spring vibrator is needlessly destructive. Instead of attempting to increase the E. M. F. it is better to reduce the length of coil, and by adding resistance through the secondary rheostat we are able to switch from one coil to another without startling the patient or reducing the current to zero. 1,500 yards of No. 36 coil with an E. M. F. of four cells will usually deal with the acute inflammatory stage of extreme tenderness.

Continue the application with a gradual regulation of the current strength up to the point of complete relief of all pain, and when this state of sedation is achieved do not abruptly stop the current but continue fully fifteen minutes longer. The process of closing the *séance* must be gradual. Reduce the current a very little at a time until it is scarcely perceptible, and after maintaining at this point until it is *not felt at all* reduce the current to zero through the rheostat so slowly as to consume a couple of minutes. Finally switch the cells out of circuit and withdraw the electrode.

The entire application may require thirty minutes or an hour, and *the relief afforded will be temporary at first but will become more and more permanent in proportion to the arrest of the inflammation.* The return of pain in a few hours is a signal to renew the application, which may be again repeated in the same manner. The duration of the application is governed by the effect, and while it must be long enough to produce the effect the length of time required will diminish after the first few applications.

Four treatments may be needed during the first twenty-four hours, and this frequency is reduced as the pain disappears and the inflammation subsides until the acute symptoms are con-

trolled by one application per day. When retrogression is established and only the effects of the inflammation require treatment there will be far less need for an electrolytic current than when bipolar sedation is not used. When it is required the technique is as follows:

Vaginal Galvanic Application.—Saturate a felt-covered, flat electrode, 7 × 10, in the usual hot-water solution of soda bicar-

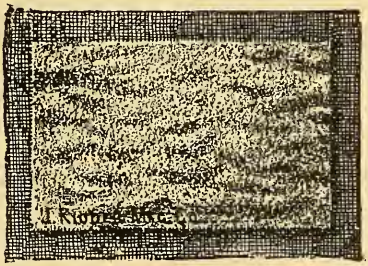


Fig. 145. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

bonate and apply it to the abdomen. For the first application connect it with the negative pole. Wrap as large a pledget of absorbent cotton around the vaginal carbon ball electrode

Fig. 146. Carbon ball electrode.

as can be inserted into the cavity without distress to the patient. Moisten it in the hot bicarbonate of soda solution, connect it with the positive galvanic terminal, and either with or without a speculum insert it as deeply into the posterior cul-de-sac as it will go. Support the handle so that it is retained comfortably in position throughout the application.

Gradually increase the constant galvanic current through the rheostat from zero up to about 15 or 20 mil., or only suffi-

cient to gradually produce a perceptible sensation of increasing comfort, during the *séance*.

After about fifteen minutes reduce the current gradually to zero and withdraw the electrode. If a small amount of tolerance to the current and great tenderness and irritability indicate still further use of the positive polarity the same application may be repeated for several days before attempting to hasten absorption with the negative current.

As soon as the acute symptoms have sufficiently subsided to indicate the use of the negative pole the galvanic application requires no other change than making the intra-vaginal electrode negative and increasing the amperage of the current as increasing tolerance develops. At the close of each sitting a carbolic and glycerin tampon may be inserted.

Under treatment of this character pelvic peritonitis is brought under control, and after acute symptoms have subsided the recent exudates are rapidly removed, in some cases quite completely and in others sufficiently to produce complete symptomatic relief. In grave septic cases the above measures are useless.

Case 1. Mrs. C——, age 25; was called on account of severe pain and vomiting; found great depression, temperature 103 degrees, severe pelvic pain, had been vomiting for several hours. Suspecting the cause to be pelvic, made examination under an anæsthetic, as the patient could not be touched, so great was the pain and tenderness. The left ovary could not be mapped out on account of a large mass of exudation filling that side of the pelvis, and crowding the uterus well over to the right side. There was evidence of an old endometritis, and the conclusion was that we had a case of parametritis of probable septic origin, and that the pain and vomiting was caused by pressure upon the ovary from the adhesions and exudation. A bipolar electrode (modified from the well-known Apostoli electrode), with bifurcated cord, and connected with positive pole of a high-tension Faradic battery, was introduced per vaginam, and a suitable pad, 6 by 6 inches, placed over the solar plexus, and with single cord attached to the negative pole. It may be well to state in this connection that the secondary coil used was composed of 1,541 yards of No. 36 wire, that the primary was excited by six cells controlled by a

rheostat in the battery circuit, and the vibrator was capable of very fine adjustment and very rapid vibrations. A *séance* of twenty minutes was given, affording great relief from pain and entire cessation of vomiting, and lowering the temperature to 101 degrees. The applications were repeated every two to six hours, as indicated, for two days, resulting in such amelioration of all the symptoms that the patient became entirely comfortable and free from pain except when an effort was made to move about. Temperature normal; no vomiting. Applications were continued twice daily for ten days, when galvanism was employed to remove the exudation by electrolysis. It is only fair to say, however, that the Faradic current was continued daily, and no doubt contributed materially to the ultimate removal of all the adhesions and exudation, restoring to health a case which ordinarily would be considered a subject for a hysterectomy, as soon as the patient could be got in a condition for operation.

Case 2. Miss R——, age 40; applied for relief from severe pain in left iliac region; temperature 102 degrees; gave history of soreness and inclination to stoop with pain when an attempt was made to stand erect. For twelve hours previous to being seen (June 4, 1895), pain had been severe, which was only partially relieved by ¼ grain morphia. Examination per vaginam showed great tenderness—could not allow any pressure over left iliac region. The left fallopian tube was enlarged and very painful, a hard exudation filling Douglass cul-de-sac, and also above the bladder, the latter causing great pain when the urine was voided. The diagnosis was pyosalpinx, with para-uterine inflammation. Bipolar faradization was given for thirty minutes, with great relief from pain and reduction of temperature to 99 2-10 degrees. The patient slept two hours, and upon awakening complained of only a partial return of pain; temperature 100 degrees. The application was repeated, and again followed by relief of pain and lowering of temperature to 99 degrees, and a longer period of comparative comfort. Treatment continued every four hours for two days. By this time active inflammation had subsided, and negative electrolysis was employed to evacuate the tube into the uterus. This measure proved successful, the patient reporting next day a discharge of two or three ounces of thin pus per vaginam, and an examination proved that the tube had been evacuated.

The faradization was continued every other day, which with appropriate galvanism disposed of the exudation and adhesions. Curetting was advised, with the view of disposing of the endometritis, facilitating drainage of the tube to prevent a recurrence. This the patient has so far declined to do.

Case 3. Mrs. N——, aged 24. When first seen patient complained of severe pain in the head and back; pulse 120; temperature 104 degrees. Gave history of dysmenorrhœa, and as her menstrual period was then due, it was apparent that the cause of her suffering was due to extreme congestion. Hot vaginal douches were ordered, and pot. bromide, followed by morphia. After four hours with no relief, bipolar faradization was resorted to, with considerable diminution of the pain; repeated in two hours, with the effect of bringing on the menstrual flow and complete subsidence of pain, abnormal temperature and nervous distress. The usual period of these applications is fifteen minutes, governed, however, by circumstances, of which the attendant must be the judge in each particular case.

Points for consideration are the pathological conditions present: what is desired to be accomplished, frequency of applications and a thorough conception of the power and limitations of the apparatus used. It is a great mistake for any one to expect uniform favorable results from the use of coil currents, or in fact any form of electricity, till the principles of electro-physics are well understood, and for gynecological work the special training and experience which must constitute the equipment of a successful specialist should always include the other necessary attributes of a good physician. (*Phelps.*)

Chronic Peri- and Para-Metritis, and Inflammatory Exudations within the Pelvis after Primary Acute Inflammation has Subsided.—The electro-therapeutics of pelvic inflammations may properly be regarded as (1) preventive in the acute stage preceding exudation; (2) curative and reparative in the recent stage of exudation and (3) pallative when the damage is chronic and complicated.

Acute congestion and inflammation is to be combatted in all cases by vaginal bipolar faradic sedation, applied with gentleness, maintained for long *séances*, and repeated as often as needed for the relief of the patient, as previously directed in the treatment of pelvic peritonitis. It is absolutely impossible to oversoothe an inflamed tissue, and if the induction coil apparatus and electrode are of the proper type and the correct dose is directed with discretion there is not only no harm to fear in thus attacking the most violent inflammation but there is a positive certainty of benefit.

This method does not in any way interfere with other medical prescribing, but it co-operates efficiently with the best methods of other treatment and practically assures a favorable termination in the case. It is the first step to the treatment of every case whether acute or chronic to prepare the way for the second step.

During the early treatment of pelvic exudates, before a carbon ball electrode is tolerated, an excellent method of applying the galvanic current is as follows:

Moisten a felt-covered, flat electrode, 7×10, in a one per cent. hot-water bicarbonate of soda solution and apply it upon the abdomen with the patient in the dorsal position on the operating table. Connect this with the positive galvanic pole.

Prepare about three quarts of any preferred alkaline and antiseptic solution in an irrigating jar placed at a sufficient height to administer an ordinary vaginal douche.

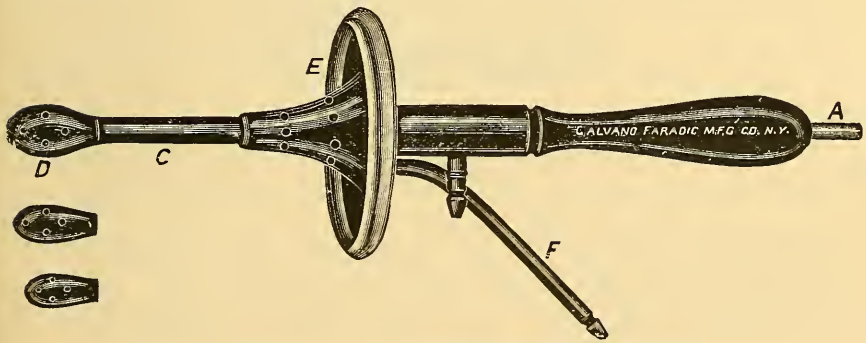


Fig. 147. Electrode for vaginal hydro-electric applications.

Attach the end of the rubber tube to the vaginal electrode and connect the electrode to the negative galvanic pole. Have the water hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Immediately increase the constant galvanic current from zero up to comfortable tolerance, and maintain the current until the irrigator is empty, or for fifteen or more

minutes. Repeat this electrical application daily for a few days, if convenient.

The solution distends the tissues, comes in contact with all parts and is a superb tonic as well as an electrolytic application.

The second stage of the case dates from the time when a cotton wrapped carbon electrode moistened in a warm soda-bicarbonate solution can comfortably be placed within the vagina and a galvanic current applied.

When this stage is reached saturate a felt-covered, flat electrode, 7 × 10, in the usual hot-water solution of soda-bicarbonate

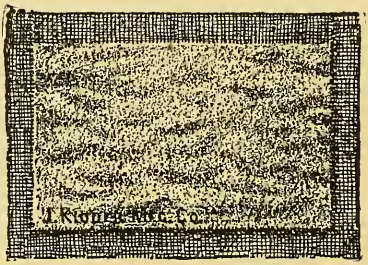


Fig. 148. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

and apply it to the abdomen with firm contact. For the first application connect this with the negative pole.

Connect the positive galvanic pole with the carbon ball elec-

Fig. 149. Carbon ball electrode.

trode and wrap around it as large a pledget of absorbent cotton as can be inserted into the vaginal cavity without distress to the patient. Moisten it in the hot bicarbonate of soda solution,

and either with or without a speculum insert it as deeply into the cavity as it will go, and support the handle without pressure.

Gradually increase the constant galvanic current through the rheostat from zero up to about 20 mil., and after five minutes advance the current gradually to determine the maximum tolerance of the tissues. If this proves to be below 30 mil. the positive applications should be continued until sufficient sedative effect is produced to permit the use of the negative current without exciting fresh irritation.

If the tolerance of the internal tissues comfortably demonstrates a capacity for 50 mil., the negative current may be employed at the next sitting and thereafter conduct the case to a close.

Follow each galvanic *séance* with the bipolar induction coil current which is to be continued as auxiliary to galvanic electrolysis, with applications merging gradually into the shorter coils and more tonic currents. As improvement progresses the bipolar part of the sitting is gradually reduced from twenty down to fifteen and ten minutes or less.

If, at first use of the galvanic current, or at any subsequent time, a renewed irritation appears (not necessarily on account of the treatment) it is only required to return to bipolar faradic sedation and wait until the improved state is restored again.

What may be called the third stage of treatment is the stage in which the electrolyzing action of the negative galvanic current can be applied locally for its softening, liquefying and absorbing action upon the inflammatory deposits.

If the case is chronic when first seen the exact indications for preliminary treatment can be readily determined at the first examination. If bipolar faradic sedation is temporarily indicated it should be employed until it ceases to be called for. If the tissues are irritable, sensitive to pressure, soft and hyperæmic so as to require the sedative, anti-congestive, astringent, drying, tonic, positive polar action of the constant galvanic

current, it should be employed after the first essential *séances* of bipolar sedation have paved the way.

If the tissues are indurated and insensitive, so as to require and permit the softening, relaxing, liquefying, absorptive action of the negative galvanic pole, no previous applications of positive need be made but the negative current can follow the usual introductory sitting of bipolar faradization.

While any single term employed to designate a disease which passes through the complex stages of inflammation fails to present a clinical picture to the eye until the patient is seen and examined, yet the indication for the uses of the three great remedies—induction coil currents, positive and negative electrolysis—is clearly defined to the student of electro-physiology during the same examination which is required to arrive at even a partial diagnosis.

Having now the state presented which demands negative electrolysis it will be necessary to rapidly push the current strength to a much greater amperage than before. The insensitive condition of the tissues will assist to permit this, but it must also be accomplished by management of the electrodes. When more than 50 or 60 mil. is used it is well to double the external electrode and place a pad upon both the lower abdomen and the sacrum connected with a bifurcated cord.

If the pelvis is large and will permit the insertion of the

Fig. 150. Cup electrode for holding clay for application : three sizes.

carbon ball wrapped with sufficient absorbent cotton to conduct 75 mil. without burning effects it may be used up to this point, but as the best effects are sometimes only to be obtained in chronic indurations by the use of currents running up to 125

mil., it is best to wrap the carbon ball with a thick layer of clay moistened to the consistency of putty and tied in place with a piece of cheese cloth and saturated with the usual warm water solution of bicarbonate of soda. This protection will safely apply currents of almost any therapeutic amperage without local injury to the surface of the mucous membranes.

Repeat negative applications twice a week so long as symptomatic improvement continues. When this finally ceases the general health of the patient may be maintained by an occasional return for applications whenever she feels any temporary aggravation.

The prognosis in the very worst cases is better under skilful electrical treatment than under any other plan, and if the chronic case is so badly damaged that some form of operation is necessary electricity prepares the way for it and promotes recovery afterward.

In the event that surgical measures are not required we may feel confident of procuring symptomatic relief and giving the patient a life of comparative comfort by the judicious use of the different electrical currents. Accessory intra-uterine or other applications are not referred to in this section although they are often an essential part of treatment, but they are fully described elsewhere and the practical physician will always attack the entire pathological condition.

Of the results of treatment by methods which are here described Martin records :

I have found the greatest satisfaction in treating inflammatory exudations in the pelvis. This includes all cases from the simple thickening of one of the broad ligaments to complete fixation of all the organs of the pelvis with a thick unyielding exudate matting everything together. The exudate will gradually but perceptibly disappear, the pain from pressure upon nerve fibres and nerve points will rapidly diminish, sympathetic disturbances will be relieved, displacements caused by contracting bands will gradually give way and the general mobility of the pelvic organs will return ; while coincidently the general health is restored from the effects of the improvement upon the general system.

Clinical Remarks.—Some of the diseases of the uterus and uterine appendages are so associated together that clinical separation of the exact structures involved is either impossible or without therapeutic value. Other lesions are so obscure as to make an accurate diagnosis depend upon a surgical operation or an autopsy.

It is one of the happy consolations of electro-therapeutics that curative results are frequently achieved, or at least a symptomatic cure is effected, without regard to mistakes in scientific diagnosis. Even without any attempt to classify the lesion in terms of advanced nosology we may select and apply the various medical currents of electricity in accordance with unmistakable major indications which can successfully guide the therapeutist even when they fail the diagnostician.

For the relief of symptoms within and without the pelvis dependent upon functional derangements or pathological but non-operative conditions I know of no remedy so reliable as skilfully handled electricity. The possession of improved apparatus and reasonable skill in technique will revolutionize the treatment of pelvic diseases so far as the individual physician is concerned, for it is impossible to witness the results and afterwards prefer the inferior topical applications and local methods which are so generally useless.

The ordinary resources of medical gynecology may be judiciously employed to supplement the action of electro-therapeutic currents, but considered separately and measured by recorded results it is a liberal estimate to credit them with 20 per cent. of the efficiency of electric currents in the treatment of some of the intractable conditions to which the properties of electricity are adapted.

With so much to commend them it may be asked, "Why are not electric currents in more general use in the treatment of disease, especially in office practice?"

In reply it can be stated that their use *is rapidly and steadily increasing.* The medical world has never been so alive to their advantages as it is to-day, and Roentgen's discovery of a

diagnostic aid which is becoming indispensable in surgical and medical examinations has revealed anew the great value of a therapeutic agent which medicine cannot do without.

The variety of uses to which electrical currents are daily put, and the benefits accruing from them in medical practice, are not yet generally appreciated, but knowledge is now rapidly spreading and each year instructs a new generation of physicians in the A B C of the subject.

Above all, however, enlightened discussion following upon the discovery of the X-rays has wiped out as with a sponge the strong prejudice which a long and hitherto uninterrupted apathy on the part of medical colleges permitted to remain.

The old physician may say: "Yes, we tried electricity twenty years ago, but it didn't work." The telephone didn't work twenty years ago, and X-rays didn't work two years ago. Strides have been taken in many directions since the Nestors of the profession went to school. Electricity is absolutely dependent for all its uses, whether these are scientific, industrial or medical, upon mechanical inventions; and in common with the telephone, the phonograph, the electric motor and the electric light, electro-medical apparatus has been developed by improved inventions.

One by one the therapeutic Gordian knots have been cut, and instruments of scientific construction now produce each different medical current with facilities of control and modification which enable the experienced operator to demonstrate in clinical practice that electricity stands very near the first place among curative remedies within the field of its physiological action.

Acute Catarrhal Endosalpingitis.—Supplementary to the ordinary method of treatment and absolute rest is vaginal *bipolar faradic sedation.* It will lessen the tumefaction, congestion and pain, impart a very great sense of relief and repose and may be repeated *as often as is required* to maintain entire freedom from pain. It renders opiates less needful and is much

more satisfactory. The technique is so often described in these pages that the reader is familiar with it.

Subacute Catarrhal Endosalpingitis.—Maintain the vaginal bipolar faradic sedation as the chief treatment with a gradual increase of current strength as tolerance develops. One treat-

Fig. 151. Bipolar vaginal electrode.

ment per day is generally sufficient. As soon as it is indicated employ a mild positive galvanic current, with the carbon ball electrode covered with absorbent cotton and placed in the cul-

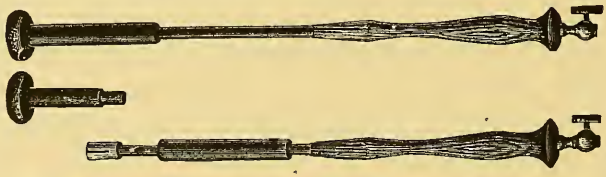


Fig. 152. Carbon vaginal electrode with removable carbon tip.

de-sac. Apply the negative electrode to the abdomen. Gradually increase the constant galvanic current from zero up to 10 at first, and, later, 20 to 30 mil.; apply for ten minutes about three times a week, and follow each sitting with the usual bipolar sedation, which is still used daily. Intra-uterine applications are neither necessary nor judicious.

Chronic Catarrhal Endosalpingitis.—Vaginal bipolar faradization still remains the severeign remedy to relieve pain and tenderness, to hasten absorption and promote drainage by way of the uterine canal. Repeat daily, with the dosage proportioned to the tolerance of the tissues, and supplement the

sedative and tonic action of the high-tension induction coil current by the alterative and electrolytic properties of the

Fig. 153. Bipolar electrode.

positive galvanic current applied within the vagina by the carbon ball electrode wrapped with absorbent cotton.

In the more chronic stage the galvanic dosage which began

Fig. 154. Carbon ball electrode.

with 15 or 20 mil. may be gradually increased to 50 mil. It is greatly aided by the bipolar application which should be given immediately after at the same sitting.

Catarrhal Salpingitis.—The indications for treatment in the acute or less chronic stages are to be found in pain, tenderness and congestion.

These are always guiding symptoms for the use of vaginal bipolar faradic sedation. Initiate the treatment with this method and pursue it until all irritation has subsided.

Then make a tentative trial of positive intra-uterine galvanism with mild currents. If there is any deficiency in drainage the negative pole should first be used to correct this, but the positive polar action is indicated for the inflammation.

The method is that of treating simple endometritis. Either

metallic electrolysis or simply the positive current with a platinum electrode may be used. Zinc amalgam electrolysis is often preferable.

When the tubal inflammation does not subside entirely with an improvement in the endometritis, or is in the chronic stage when first seen, it calls for local positive galvanic treatment.

Place a felt-covered, flat electrode, 7 × 10, upon the lower

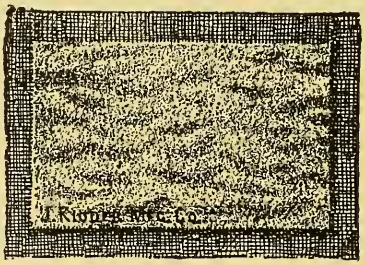


Fig. 155. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

abdomen, after saturating it with the invariable bicarbonate of soda solution. Connect it with the negative pole of the galvanic switchboard. Wrap the vaginal carbon ball electrode with as large a protecting mass of absorbent cotton as will

Fig. 156. Carbon ball electrode.

comfortably enter the cavity. Wet it with the warm soda-bicarbonate solution and press it only just dry enough to prevent dripping. Insert it in the vagina so that it rests against the affected tube. Increase the positive galvanic current from zero up to comfortable tolerance, maintain for about ten minutes and reduce gradually to zero. Close the sitting with a suitable tampon if the condition requires it.

The galvanic dosage will vary with increasing improvement all the way from 15 or 20 mil. at the first sitting to 35 or 40 mil. after a few treatments, but this dosage will rarely need to be exceeded. When a tolerance of 40 mil. is reached the sittings may be repeated twice a week, and an intercurrent treatment given with bipolar faradization. Adjuvant treatment must be carried out according to the needs of the individual case.

The *curative* efficiency of *bipolar faradization* relates to the more acute and simpler cases, with little or no extension beyond the mucous lining of the tube.

The *palliative* efficiency of *bipolar faradization* makes it a valuable remedy in all varieties and degrees of catarrhal salpingitis, even when the inflammatory process has spread deeper than above stated.

The *curative* efficiency of the *galvanic* current relates to the more chronic forms, with extension of the inflammation into the interstitial and surrounding tissues, thickenings and other results short of pus. The presence of pus is a contra-indication for local treatment until it is evacuated.

The vaginal bipolar method, with a proper induction coil apparatus rightly adjusted, is safe in any careful physician's hands who has had a reasonable experience with it, but when galvanic currents are directed against inflammatory lesions of the uterine appendages the case should be in the hands of one who is competent to employ it. It requires very little trouble and study to become practically conversant with the physiology and theraupeutics of galvanic currents, and it is certainly necessary for the physician to have some preliminary experience before making applications which require ordinary skill.

In some instances of suppurating salpingitis a free discharge of the pus and drainage through the uterus has followed an ordinary intra-uterine application of the negative galvanic current, which has apparently dilated the orifice of the tube. Some years ago Dr. W. B. Sprague reported a number of cases in which he had been able to empty the tubes. In some

cases this is an accidental achievement, and in other cases it has been successfully accomplished by operators who have directed the intra-uterine electrode-sound so that it has entered the tube itself. In any case of suspected suppuration the intra-uterine negative application of the galvanic current should be limited to a mild dosage of under 30 mil.

Remarks.—Tubal inflammations, whether first seen in the acute, sub-acute or chronic stage, or when undergoing acute aggravation, are all amenable to treatment with a fair prognosis, both as to relief of symptoms and final cure, by the conjoint employment of *vaginal bipolar faradic sedation* and *vaginal applications of the galvanic current.*

Full details of these methods are repeated so many times in these pages that the reader is thoroughly familiar with them. Surgeons are apt to say that the treatment by electrical currents is "tedious," but no one who has witnessed the sometimes long lingering results of disappointing surgery, or experienced the tedium of routine gynecological practice, will fail to regard the resources of pelvic electro-therapeutics as a satisfactory means of obtaining satisfactory results. The value of an operative procedure is not to be measured by counting the minutes it takes to do it. Patients find this out by experience.

Suppurative Salpingitis.—The failure of vaginal bipolar faradic sedation to relieve pain in any case of salpingitis points at once to the presence of a cause which it cannot reach. With pain due to distention of the tube, evacuation is the only thing that will afford relief. Many of these cases of purulent salpingitis are cured, and remain permanently cured, without removal of the appendages, or any other surgical operation which not only does not always cure the disease, but often leaves the patient in a worse state than before.

The most experienced pelvic surgeons become most conservative in removing tubes and ovaries until time and other methods of treatment have failed to relieve, and no case can be considered as having been thoroughly treated until the

resources of skilled electro-therapeutics have been employed. A tube will often drain through the uterine cavity.

The chief difference between the treatment of a suppurative salpingitis and a simple inflammation is the greater degree of caution that is required, and the operator must know how to correct possible aggravations by altering his technique to conform to the individual case.

While the presence of pus is cited as a contra-indication for electricity, and is in fact a contra-indication for certain forms of treatment, it is nevertheless no reason for debarring the patient from modified applications which are likely to do her good. That a tube may be made sufficiently patulous by negative intra-uterine galvanism to permit natural drainage has been demonstrated in a great many cases.

When however the pains continue and the general condition is aggravated and the patient shows a decreasing instead of an increasing tolerance to the treatment, it is evident that the collection of pus cannot be evacuated by conservative measures with electricity.

The positive pole of the galvanic current is generally contra-indicated in suppurative salpingitis.

Treatment.—When the uterine end of the tube is patulous but the secretion drains imperfectly into the uterus, and when there is no acute inflammation present, the treatment is as follows:

Moisten a felt-covered, flat electrode, about 6×9, in the hot-water bicarbonate of soda solution, connect it with the positive galvanic pole and place it over the hypogastrium. Wrap a protecting mass of absorbent cotton around the carbon ball electrode, saturate it in the same solution, connect it with the negative pole and insert it gently into the vagina so that the ball is in contact with the affected tissues.

Very gradually increase the constant galvanic current from zero up to the point of comfortable tolerance, which at first may be only 20 or 30 mil. In about five minutes gradually reduce to zero and withdraw the electrode. Immediately in-

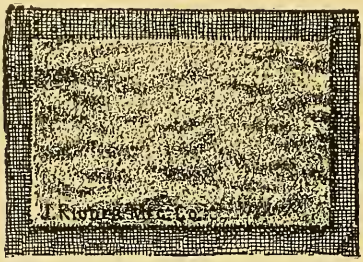


Fig. 157. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Fig. 158. Bipolar vaginal electrode.

sert the vaginal bipolar electrode and stimulate peristaltic action by a rapidly interrupted high-tension current regulated to comfortable tolerance.

Fig. 159. Carbon ball electrode.

If pain is relieved, if the secretion is liquefied, and drainage improved after two or three tentative treatments of this kind, it may be considered that aggravations are not likely to be caused and we may proceed to more active measures.

At the next sitting proceed precisely in the same way but substitute for the carbon ball an intra-uterine electrode-sound, connected with the negative pole. Adjust the dosage in the same manner and gradually carry it from 20 up to 50 or possibly up to 80 mil. as tolerance increases and it becomes certain that no aggravation will be excited by the use of con-

siderable current strength. Maintain the maximum dosage from three to five minutes, follow this with the usual bipolar faradic sedation, and carry out the general principles which I

Fig. 160. Intra-uterine electrodes.

have described so that they are now familiar to the reader of these chapters.

The negative intra-uterine action favors the escape of pus, which is often reported by the patient after only one or two treatments. It relieves congestion and quiets the pain, and when the conditions are not absolutely unfavorable (a rare case), it produces rapid improvement, which increases and persists.

As a matter of fact the reader who will study the principles of treating inflammation, whether acute, chronic or suppurative by the aid of electrical currents will successfully carry out the same principles without discussion about the tissues involved.

Abscess of Fallopian Tube.—In December of last year Mrs. L., widow, 22, had her menses suppressed by cold and had pelvic cellulitis and evidences of the formation of abscess in the left Fallopian tube or ovary. After general treatment it was deemed proper by consultants to make a laparotomy, but she objected, and after washing out the uterus repeatedly with sublimate solution, though not finding any evidence of intra-uterine disease, the experience of Dr. Lapthorne Smith occurred to me, and I introduced a uterine electrode and carried its point to, and possibly engaged it within, the left tube, connected it with the negative pole, placed the positive electrode in her hands and administered a current of 15 ma. carefully through Massey rheostat for eight minutes. This caused considerable pain, and rather severe back pains followed the treatment and continued for about two hours, when she suddenly got relief, and this was accompanied by a profuse flow of pus from the uterus. From this moment she improved, and about the only other treatment given was a hot vaginal douche of 1 to 4,000 solution of sublimate, twice daily. The discharge

of pus continued freely for about three days and then gradually diminished and in the course of three weeks ceased. She passed the time for her next period without menstruating, except to the extent of a mere show on one day, and then began to suffer pains and from abdominal tenderness; and it seemed that she was likely to have another attack of inflammation and suppuration. Feeling sure now that the trouble came from stricture of the left tube I repeated the electrical treatment, but only using a current of 10 ma. eight minutes. This was followed by backache and increased soreness about the left ovary, but during the night her courses came on freely and she afterward had no serious difficulty and has since menstruated regurlarly, and is now in perfect health. (*Woolsey.*)

Remarks upon Suppurative Peri-Uterine Inflammations.—When it is known that an inflammatory process is purulent the resources of electro-therapeutics alone do not offer the ideal treatment. Sometimes they are valuable adjuncts, sometimes they succeed fairly well, and in such desperate cases as septic peritonitis they are without avail. Nevertheless we must in electro-therapeutic practice find our patients in one or the other of the following classes: 1. Those who are amenable to electrical treatment. 2. Those who are in a condition so bad that operation offers but little chance of recovery and the surgeon declines. 3. Those who should be operated upon but who positively refuse.

In all but the rapidly fatal septic cases electro-therapy provides safe and sometimes excellent palliative treatment. Sometimes the aid of electricity will allow a very minor surgical operation to take the place of a more serious one. All methods must be employed as indicated to secure the best results, for no one branch of medicine covers the whole field of practice.

Pelvic Hæmatoma and Hæmatocele.—When, in any case of this nature, it is deemed practicable to assist absorption by the aid of an electric current the expert may safely employ a valuable remedy which should never be attempted by the tyro.

The immediate primary indications are thus given by an authority on the subject: "To check the hemorrhage when the case is seen early enough, to produce coagulation of the

diffused blood as quickly as possible and prevent a recurrence of the hemorrhage, to subdue pain and prevent inflammatory complications, to promote absorption and prevent suppuration and the formation of abscess, and by a speedy convalescence shorten the confinement in bed. The demonstrated positive polar actions of the galvanic current fulfil these indications."

With the patient in the dorsal position in bed place a felt-covered, flat electrode, 7 × 10, well moistened in a warm solution

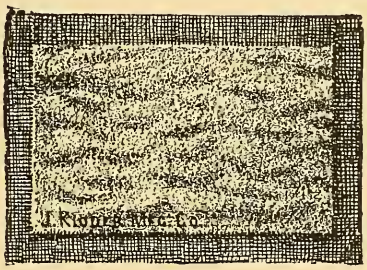


Fig. 161. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

of bicarbonate of soda (about a teaspoonful to the pint), upon the abdomen and a similar pad under the sacrum. Connect

Fig. 162. Cup electrode for holding clay for application : three sizes.

them with a bifurcated cord to the negative pole of a portable galvanic battery.

Make up the clay-covered carbon vaginal electrode in the usual manner and moisten it thoroughly with the warm bicarbonate of soda solution. Connect it with the positive galvanic pole and carefully insert it against the tumor.

Increase the constant galvanic current with slow and persistent advances until the greatest tolerance of the internal electrode is reached. It may require fifteen minutes to attain the maximum current strength in a cautious manner, and the aid of a moderate or partial anæsthesia will be necessary if the patient is in great pain.

When the current strength has been raised to the greatest possible amperage and passes the border line of tolerance, reduce it a few milliamperes to restore comfort to the patient, and maintain this maximum dose for about five minutes. Gradually reduce the current another 10 mil. and withdraw the action very slowly until zero is reached.

Repeat daily until hemorrhage not only ceases but pain is relieved and inflammation aborted. After the first application which accomplishes these effects the same treatment at longer intervals with milder dosage must be directed by the individual case. The indications later for bipolar faradization will also be recognized and met.

CHAPTER XXV.

TREATMENT OF MISCELLANEOUS PELVIC CONDITIONS.

Vaginismus. Treatment of simple and gonorrhœal vaginitis. Vaginal leucorrhœa. Prolapse of the vagina. Vulvitis. Pruritus vulva. Eczema of the vulva. Treatment of dyspareunia. Sterility. Treatment of uterine causes. Neuroses having their origin in uterine conditions. Urethritis in the female. Stricture of the female urethra. Functional disturbances of the urethra and bladder.

Vaginismus.—Bipolar faradic sedation is the efficient and only needed remedy for this intense hyperæsthesia of the vulvar outlet and spasm of the constrictor vaginæ muscle.

Place the patient in the usual dorsal position upon the operating table, warm and lubricate the vaginal bipolar electrode and insert it carefully into the entire depth of the cavity. If nervous dread or spasm makes this at all difficult for the operator to do it may sometimes be more easily accomplished by the patient herself.

After it is in position connect the conducting cords so that the tip is positive and maintain it securely in position during the entire sitting.

Fig. 163. Bipolar vaginal electrode.

Switch the 1,500 yard No. 36 coil, the rapid vibrator and four cells into circuit. Increase the current from zero up to the point of comfortable tolerance, and in two or three moments again increase it until the current is as strong as the patient

can bear without fatigue or pain. If the 1,500 yard coil is not adequate to produce the desired dose switch the 1,000 yard No. 36 coil and test its efficiency.

Maintain a strong current for fifteen minutes and gradually reduce to zero. Repeat daily or every second day or at the convenience of the patient until relief is complete. Benefit will be obtained at the first sitting, and in a case of this kind without complications but very few treatments will be required. If the mucous membrane is dry the natural secretion will also be restored.

The following case was treated by an inferior method but the result was satisfactory.

Patient aged thirty; since her marriage five years ago the trouble has gradually grown worse. The contractions were most distressing, coming sometimes any hour during the day, especially when under any excitement; a sudden change in position when asleep would also bring them on; would last ten to thirty minutes. Has had two surgical operations performed with negative results. Two months after the last operation, when all other methods of relief had been exhausted, I commenced using faradic electricity. For my vaginal electrode I used a medium-sized Pratt's rectal dilator, to which was attached the rheophore from the positive pole—the other pole was placed over the uterus. The insertion of the dilator caused intense and painful contractions, which were partially relieved when the current was turned on. At first a mild current from a long-coil No. 32 wire was used for fifteen minutes. Each day the current was increased until it was as strong as could possibly be borne—it was then given twice a day and for forty-five minutes each time. Under this treatment there was a steady improvement until, at the expiration of three months, the patient declared herself relieved of the trouble. (*Gardner.*)

Vaginitis.—Simple acute and sub-acute inflammation of the vaginal mucous membrane may be satisfactorily treated by vaginal bipolar faradic sedation combined with some of the simpler accessory medication. The sedative coil current should be applied according to the directions given for the treatment of other acute pelvic inflammations (see INDEX) and repeated p. r. n.

When the condition is chronic, and especially when gonorrhœal and accompanied with leucorrhœal discharges, the superior method is the application of a galvanic current combined with an antiseptic solution by means of the hydro-electric douche.

Douche Method.—Moisten a felt-covered, flat electrode, 7 × 10, in a one per cent. hot-water bicarbonate of soda solution and apply it upon the abdomen with the patient in the dorsal position on the operating table. Connect this with the posi-

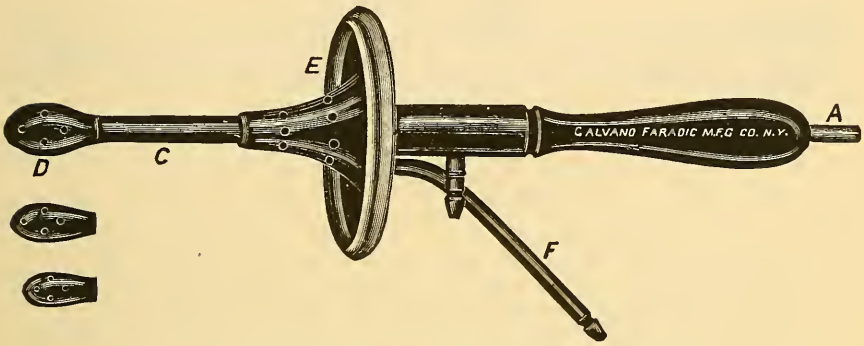


Fig. 164. Electrode for vaginal hydro-electric applications.

tive galvanic pole. Prepare about three quarts of any preferred alkaline and antiseptic solution in the irrigating jar placed at a sufficient height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal electrode and connect the electrode with the negative galvanic pole. Have the water hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Gradually increase the constant galvanic current from zero up to tolerance and maintain the current until the irrigator is empty, or for fifteen or more minutes. Prescribe other measures if indicated. Repeat the electrical application daily for a few days and three times a week until recovered.

Gonorrhœal Vaginitis.—Moisten a felt-covered, flat electrode, 7 × 10, in a one per cent. hot-water bicarbonate of soda

solution and apply it upon the abdomen with the patient in the dorsal position on the operating table. Connect this with the positive galvanic pole. Prepare about three quarts of any

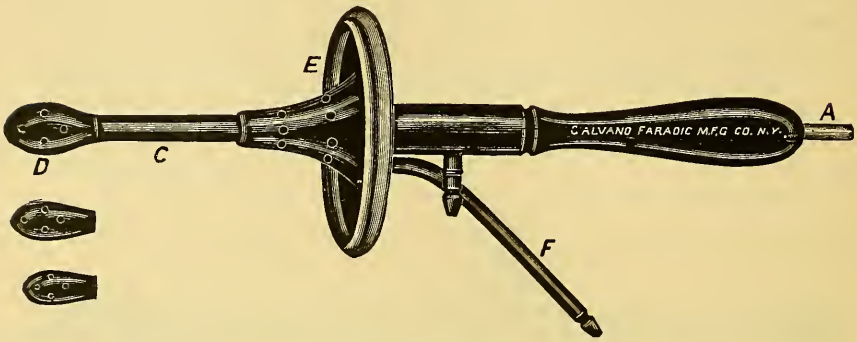


Fig. 165. Electrode for vaginal hydro-electric applications.

preferred alkaline and antiseptic solution in an irrigating jar placed at a sufficient height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal electrode and connect the electrode with the negative galvanic pole. Have the water hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Gradually increase the constant galvanic current from zero up to tolerance and maintain the current until the irrigator is empty, or for fifteen or more minutes. Repeat daily for a few days and three times a week until recovered.

Vaginal Leucorrhœa.—Moisten a felt-covered, flat electrode, 7 × 10, in a one per cent. hot-water bicarbonate of soda solution and apply it upon the abdomen with the patient in the dorsal position upon the operating table. Connect this with the positive galvanic pole. Prepare about three quarts of any preferred alkaline and antiseptic solution in an irrigating jar placed at sufficient height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal

electrode and connect the electrode with the negative galvanic pole. Have the water hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Gradually increase the constant galvanic current from zero up to tolerance and maintain the current until the irrigator is empty, or for fifteen or more minutes. Prescribe any other measures indicated. Repeat the electrical

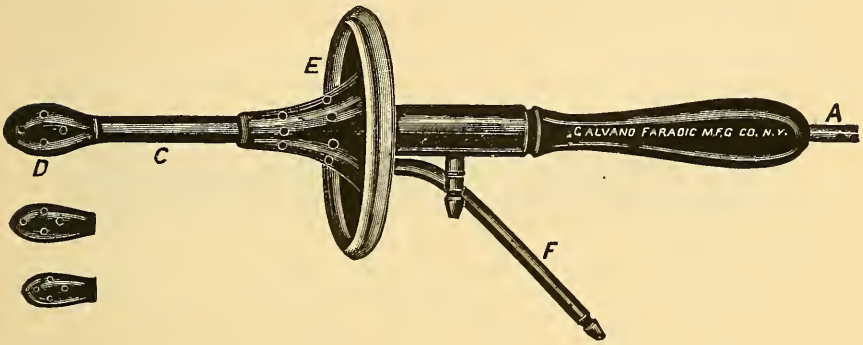


Fig. 166. Electrode for vaginal hydro-electric applications.

application daily for a few days and three times a week until recovered.

Leucorrhœal discharges, either vaginal or uterine, need no separate consideration, and generally cease during the treatment of the catarrhal inflammation of which they are a symptom. Physicians who are not familiar with the action of the galvanic current may enquire how to treat such discharges, and this occasion is taken to say that the answer will be found under the caption of the causative lesion.

Prolapse of the Vagina.—Surgical operations for the repair of a lacerated pelvic floor are the theoretical means of cure. Practically they may be refused by the patient or she may be unable to have them done, or the condition of the tissues may make their results unsatisfactory. Unless circumstances and the prognosis especially favor operative procedures the general

practitioner and the patient may feel perfectly satisfied to resign Colporrhaphies, local astringents on tampons introduced daily in the vagina, pessaries and abdominal supports, and in most cases of prolapse, rectocele and cystocele, with all their symptomatic distresses rely with confidence upon the efficient palliative, vaginal bipolar faradic stimulation.

Place the patient in the usual dorsal position upon the operating table.

Fig. 167. Bipolar vaginal electrode.

Connect the tip of the vaginal bipolar electrode with the positive pole of the high-tension induction coil apparatus, the remaining half to the negative pole, and insert it well into the cul-de-sac of the vagina.

Never use a speculum with this electrode.

Switch into action the 1,500 yard No. 36 coil, the rapid vibrator and four cells.

If the increase of current from zero to the maximum E. M. F. with this coil produces a current which is scarcely felt by the patient proceed in the usual manner to test the shorter lengths of wire until the coil is found which produces an efficient contracting current. If tenderness, congestion and irritability are present the first few sittings will tolerate only a sedative current and the technique of bipolar faradic sedation must be employed. If there is no tenderness

the treatment may proceed along the lines of tonic faradization.

Repeat sittings daily or every second day for a couple of weeks if the circumstances of the patient permit. She will rapidly reach a point of comparative comfort, and this may be maintained by ordinary care on her part and an occasional return for treatment when any relapse occurs.

By this means she will escape both the dread of an operation and the endless bondage to tampons and pessaries which are but little less of a nuisance than the disease. If subinvolution or any other lesion requiring treatment is associated with the case it will share in the benefit of the bipolar application but should be attended to according to its own indications.

The rapid relief from the discomfort, bearing down and aching pains, fatigue, heat and fullness at the vulva obtained by bipolar faradization are among the happiest effects within the range of its great clinical usefulness.

Vulvitis.—The following method can be employed in any of the ordinary forms of this affection.

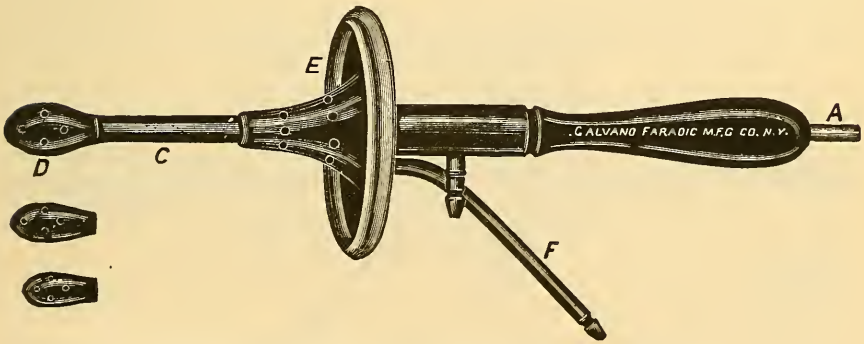


Fig. 168. Electrode for vaginal hydro-electric applications.

Moisten a felt-covered, flat electrode, 7 × 10, in a one per cent. hot-water bicarbonate of soda solution and apply it upon the abdomen with the patient in the dorsal position on the operating table. Connect this with the positive galvanic pole.

Prepare about three quarts of any preferred alkaline and antiseptic solution in an irrigating jar placed at a sufficient height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal electrode and connect the electrode with the negative galvanic pole. Have the water hot.

When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Gradually increase the constant galvanic current from zero up to about 10 mil. and maintain the current until the irrigator is empty, or for fifteen or more minutes. Prescribe other measures indicated in each individual case, repeat the electrical application daily for a few days and three times a week until recovered.

Support the electrode loosely so that the solution will come in contact with the labia.

Pruritus Vulva.—Moisten a felt-covered, flat electrode, 7 × 10, in a one per cent. hot-water bicarbonate of soda solution and apply it upon the abdomen with the patient in the dorsal position on the operating table. Connect this with the positive

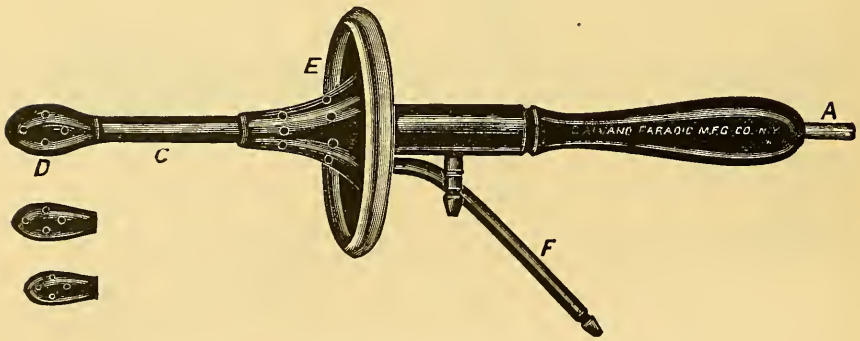


Fig. 169. Electrode for vaginal hydro-electric applications.

galvanic pole. Prepare about three quarts of a semi-saturated rock salt solution in an irrigating jar placed at a sufficient

height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal electrode and connect the electrode with the negative galvanic pole. Have the water hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Gradually increase the constant galvanic current from zero up to tolerance and maintain the current until the irrigator is empty, or for fifteen or more minutes. Support the electrode loosely, so that the flow will come in contact with the affected parts.

Repeat daily till relieved. If the condition is a symptom of diabetes treat the patient by static electricity also. (See DIABETES for clinical directions.)

Eczema of the Vulva.—After the application of the hydro-electric vaginal douche in the usual manner supplement its action by the external spray directed upon the eczematous tissues.

Moisten a felt-covered, flat electrode, 7 × 10, in a one per

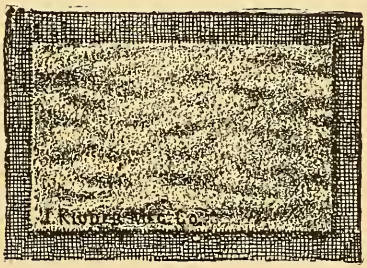


Fig. 170. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

cent. hot-water bicarbonate of soda solution and apply it upon the abdomen with the patient in the dorsal position on the operating table. Connect this with the positive galvanic pole. Prepare about three quarts of any preferred alkaline and an-

tiseptic solution in the irrigating jar placed at a sufficient height to administer an ordinary vaginal douche. Attach the end of the rubber tube to the vaginal electrode and connect the electrode to the negative galvanic pole. Have the water hot. When the electrode is inserted turn the stop-cock of the rubber tube and allow a continuous flow of the solution. Immediately increase the constant galvanic current from zero up to about 30 mil. and maintain the current until the irrigator is two-thirds empty.

Reduce the current to zero, turn the stop-cock to shut off the flow of water, withdraw the vaginal electrode and substitute the spray electrode for external use. Again start the flow of

Fig. 171. Hydro-electric spray.

both the water and the current and use the remaining third of the solution directly upon the surface of the lesion.

Repeat daily at first or every second day until improvement is sufficient. Prescribe for the general condition of the patient and especially take into account any indications for the employment of static electricity, which benefits so many of these patients.

Dyspareunia.—This frequent symptom may exist in various degrees, from mere discomfort to intense suffering, but some of its most common causes are entirely removable by electrical treatment. Special applications must be directed to special causes, but in the majority of simple conditions the local hyperæsthesia and tenderness is admirably relieved by vaginal bipolar faradic sedation. This is often the sheet-anchor of treatment for pelvic pain and tenderness, and if an examination reveals no lesion requiring other methods it should not only be employed at first but repeated p. r. n. Some of the more common affections which produce this symptom are:

Vaginismus.—This requires little other treatment than bipolar faradic sedation.

Vaginal or vulvar hyperæsthesia.—Vaginal bipolar faradic sedation is *facile princeps* in the curative treatment of this condition.

Lacerations of the cervix uteri.—When these are of a minor character a normal condition may often be restored without an operation by negative galvanic electrolysis combined with dilute nitric acid. The method is fully described under lacerations of the cervix. (See INDEX.)

Inflammations of the uterus.—These are best treated by vaginal bipolar faradic sedation combined with galvanic currents. After making a diagnosis the reader may turn to the index of this book for a complete description of the technique adapted to different degrees of inflammation. Other lesions of which the same may be said are diseases of the cervix uteri, displacements of the uterus, prolapsed ovaries, ovaritis and pelvic inflammatory exudations, all of which are considered under their appropriate headings.

Urethral caruncles—may be subjected to galvanic puncture.

Fissure of the ostium vaginæ—may be remedied by a few applications of cupric electrolysis.

Fissure of the anus, rectal ulcers and hemorrhoids—may be successfully treated by metallic electrolysis or negative electrolysis.

Almost all the conditions which produce dyspareunia, except those of an anatomical character, find among the resources of electro-therapeutics the practical means of relief.

Sterility.—The treatment of this condition so far as it relates to unfavorable conditions of the female pelvic organs resolves itself into the treatment of some one or more of the familiar lesions in which the curative value of electric currents has been effectually demonstrated.

Such causes as may be included under obstructions of the uterine canal either by stenoses of the internal Os or flexions and displacements of the uterus may often be effectively relieved by

negative galvanic electrolysis and measures described under other headings.

If sterility is apparently due to a diseased condition of the uterine membrane, this may be put in a healthy state by the aid of either positive or negative intra-uterine applications according to the local indication.

If simple stimulation of functional activity is desired the negative pole is employed.

If there is a catarrhal endometritis it should be treated with the positive pole. In some cases no catarrhal process may be suspected and yet exist in a mild form. The positive galvanic current will correct this.

In one case in my own practice pregnancy followed upon a course of vaginal bipolar faradization after three years of sterility and nearly a year of the usual routine treatment of dysmenorrhœa by an excellent physician who, however, deprived himself of the advantages of medical electricity.

When no apparent lesion can be made out by careful examination an appropriate method is a mild stimulation of the endometrium by a negative galvanic current of about 20 mil., and there is no doubt of the happy effect of simple bipolar faradization upon functional lack of tone.

Sterility has been associated with dysmenorrhœa in a great many cases, and this has led to a large experience with the action of both positive and negative galvanic currents in all doses upon the endometrium, for patients desire treatment for pain when the mere fact of sterility is negligible. The restorative action of these currents even in maximum cauterizing doses has resulted in many cases of pregnancy following electrical treatment. Those who created imaginary alarm five or ten years ago by stating that electric currents caused adhesions, atresia and sterility never had any clinical ground to stand on.

Sterility is more often due to endometritis, with the consequent alteration in the secretion from the uterine and cervical membrane, and evidence of congestion is found in the uterine

and peri-uterine tenderness discovered by digital examination.

These cases make up the majority of those which are met in practice when more serious complications are absent, and they may all be treated upon the same principles.

At the first examination, with the patient in the dorsal position on the operating table, warm, lubricate and insert the vaginal bipolar electrode and connect the tip with the positive

Fig. 172. Bipolar vaginal electrode.

pole of the high-tension induction coil apparatus. Connect the opposite half of the electrode with the negative pole.

Switch the 1,500 yard No. 36 coil, the rapid vibrator and four cells into circuit. Gradually increase the current through the rheostat from zero up to the point of producing moderate sensation, and if the patient is either nervous or extremely sensitive use care in carrying the dose beyond this point at the first sitting, for it is more important to compose the patient, allay her nervous fears and obtain her confidence in the treatment than it is to hurt her and never see her again.

Having carefully advanced the current strength to the point of comfortable tolerance, maintain it for about ten minutes and gradually reduce to zero. Repeat sittings every second day for one or two weeks, during which time it will ordinarily be found that tenderness is entirely removed and signs of local congestion are no longer present.

In any state of marked hyperæsthesia without grave symptoms there is never any particular hurry to invade the uterine canal, and patients as a rule will appreciate a little conservatism on this point.

After a sufficient number of sittings to produce complete sedation by the bipolar method we may next place a well moist-

ened felt-covered, flat electrode, 6 × 8, under the sacrum and cautiously insert either a platinum or pure tin electrode-sound.

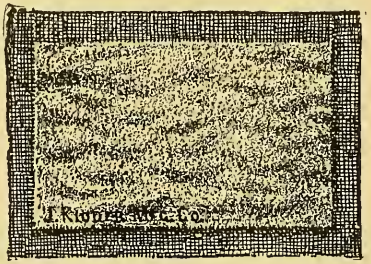


Fig. 173. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

If entrance into the uterus is attended with any spasm at the internal Os, or marked sensitiveness, or discovers any point of extreme local tenderness, connect the intra-uterine electrode

Fig. 174. Intra-uterine electrode.

with the positive galvanic pole and the external electrode with the negative.

Gradually increase the constant galvanic current from zero up to 10, 15 or 20 mil., stopping at the first sign of unpleasant sensation. Maintain the current just below the point of discomfort for a couple of moments and again increase the strength a few mil. In all cases in which the tolerance improves it may be accepted as an indication that the treatment is both proper and beneficial, for if it was doing harm the tolerance would decrease.

The length of sittings with these mild currents may be about ten minutes, repeated about three times a week between menstrual periods.

If the passage of the electrode discovers none of the usual indications for the positive pole but encounters instead a stenosis of the internal Os or an anæmic condition the electrode should be connected with the negative pole and the external electrode made positive. The remainder of the treatment including the regulation of the dose, duration and frequency of treatment is the same whichever pole is employed. The amount of treatment required will be developed by the course of events. If the next period, or the next after the first, is free from pain and more normal in character treatment may be stopped until a sufficient lapse of time determines the result.

Neuroses having their Origin in Uterine Conditions.— These neuroses may be nervous dyspepsias, headaches, neuralgias, general irritability, or run the whole gamut of hysteria.

When associated with palpable lesions of the uterus or adnexa they will improve under the conjoint action of vaginal bipolar faradization and intra-pelvic applications of galvanic currents. If a uterine cause is suspected but cannot be made out there are three methods of practical value in electro-therapeutics which are more satisfactory from a clinical standpoint than any of the ordinary forms of prescribing.

1. Percutaneous galvanism through the pelvic organs.
2. Vaginal bipolar faradization.
3 General and localized static electrification adapted to the symptomatic needs of the patient.

If the neurosis is related to functional disturbances of the pelvic viscera or nerve supply the relief afforded by one or more of these methods may be complete. In direct proportion as the neurosis is vague, elusive and apparently without a local habitation or a name, the difficulties of treatment by either medicine or other measures are simplified by these three procedures, and static electricity is my first choice.

Study the chapter upon the treatment of functional nervous diseases, and when once the knack of managing nervous patients upon the platform of the static apparatus has been

acquired the physician has the means of treating with satisfaction a class of cases which otherwise are among the trying experiences of medical life.

If the static machine performed nothing else in the treatment of disease it confers a lasting benefit upon all who use it by the masterful manner in which it often conquers vague neuroses of rebellious kinds.

I speak of this with a particular sense of gratitude to this magnificent apparatus on account of its many services to me in simplifying the treatment of neurotic and hysterical patients.

Urethritis in the Female.—The treatment of catarrhal inflammations of various stages and degrees constitutes the chief field of *metallic electrolysis.*

Place a felt-covered, flat electrode, 6 × 8, well moistened in

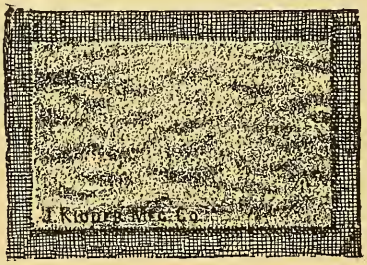


Fig. 175. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

the usual hot-water solution of bicarbonate of soda, upon the lower abdomen, or under the sacrum, whichever is most convenient. Connect this electrode with the negative pole of the galvanic apparatus.

Select for the positive electrode a sound of zinc or copper that will conform to the urethral canal and come in contact with the entire surface.

For the reason that it is non-irritating and does not adhere to the tissues, the zinc-amalgamated electrode is often prefer-

able. Select a zinc electrode-sound of proper size and brighten the surface with fine emery cloth. Next amalgamate the zinc surface with mercury and after connecting it with the positive pole of the battery insert it into the canal.

Fig. 176.

Gradually increase the constant galvanic current through the rheostat from zero up to about 20 mil., or the point of comfortable tolerance, which will vary with the stage of the inflammation. Maintain the maximum current about five minutes and gradually reduce to zero.

Repeat the application several times, at intervals of about four days.

If the catarrhal process is purulent and the application is well borne it may be repeated every second day until improvement permits longer intervals.

Strictures of the Female Urethra.—An infiltrated stricture which is the result of urethritis is rapidly and radically cured by the action of the negative galvanic current in doses of from 3 to 10 mil., applied by the same method as treatment for stenosis of the internal Os of the uterus.

Cicatricial stricture resulting from traumatism may be attacked by the same electrolytic action, but yields far less readily. When results are secured they are practically free from relapse and possess advantages over gradual or rapid dilatation or cutting.

Moisten a flat, felt-covered electrode, 6×9, in the usual hot-water solution of bicarbonate of soda and place it either upon the lower abdomen or under the sacrum, the latter situation being almost always the most convenient. Connect this electrode with the positive pole of the galvanic battery.

Select one of the same electrodes employed for the treatment of stenosis but of a size a little too large to pass through

the stricture by simple pressure. Connect this electrode with the negative pole, pass it through the flame of an alcohol lamp

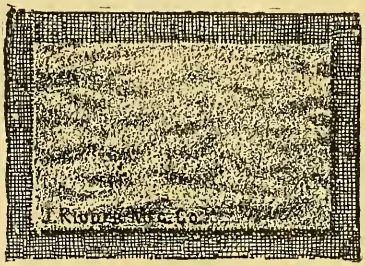


Fig. 177. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

to sterilize it, dip it in glycerine to lubricate it, and insert it into the canal as far as it will go.

Gradually increase the constant galvanic current through the

Fig. 178. Set of olive electrodes.

Handle for same.

rheostat until it produces a sensation of very gentle warmth without the slightest discomfort or pain. Unless the electrode is very small the meter should register 5 or 7 mil., or not over 10 with a large electrode.

Maintain the constant action of the current until the electrode passes the stricture and is again withdrawn through it backwards. Sufficient time should be taken to accomplish this without force, but ordinarily from 12 to 20 minutes may

be allowed for the entire application. As soon as the electrode passes the stricture in the reverse direction reduce the current gradually to zero and finally withdraw the electrode and close the sitting. Repeat about once a week.

If any irritation exists it must be allayed by the usual methods before electrolytic treatment is begun. If any fresh aggravation occurs during a course of treatment allow an interval for sedative treatment before the next galvanic application.

The number of treatments required will be a dozen or less in a case of a single fibro-plastic deposit, up to six months or more of patient treatment if the cicatrix is old and firm and especially if the strictures are multiple. See also treatment of stricture in the male for description of Linear Electrolysis.

Functional Disturbances of the Urethra and Bladder.—Although directions for local applications of both galvanic and faradic current are given in various text books for the treatment of enuresis, neuralgic and spasmodic symptoms and other neuroses of the female urethra and bladder in both women and young girls, yet such methods are not always acceptable to patients, nor always feasible for the general practitioner. The practical mind would only consider their employment as a last resort, and even as a last resort they are not very satisfactory, particularly when inferior apparatus is used.

Whatever can be done however to relieve these derangements with static electricity is both practical and acceptable, for neither disrobing nor exposure of the patient is required and there is very little tax upon either the operator or the patient.

Seat the patient upon the static platform and connect it with the positive pole. Ground the negative pole and limit the first application to about fifteen minutes of sedative-tonic electrification only, if the patient is neurasthenic and timid and requires some improvement in general health before attending to local symptoms.

After the first sitting and as soon as local applications can be agreeably made apply a persistent sedative breeze both to the cervical and lumbar spine and *over the region of the bladder.* Within two or three sittings the average patient will be sufficiently improved to permit the use of counter-irritant applications, for which the preliminary steps have prepared the way. The static breeze is especially useful in the burning pains of strangury and aids other treatment.

For the various modifications of technique refer to the chapter upon how to produce *special therapeutic effects.*

Enuresis will require in addition a stimulus to the sphincter muscles, and this is sometimes effectively obtained by means of mild static sparks to the perineum and lumbar spine. Have the patient sit well forward upon the edge of the chair on the platform connected with the negative pole.

Ground the positive pole and the electrode called the " spark

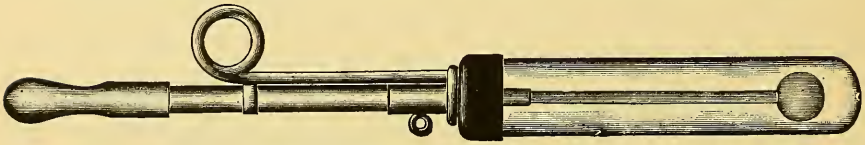


Fig. 179. Insulated spark electrode.

director " to the same grounding. Have the patient spread the limbs apart and adjust the clothing so that a few mild sparks may be directed as nearly as possible to the perineal region.

Repeat treatment daily, or every second day until relieved.

CHAPTER XXVI.

TREATMENT OF EXTRA-UTERINE PREGNANCY.

Method of galvanic application. Method of faradic application. A clinical example treated by each current.

Extra-Uterine Pregnancy.—Treatment of this condition by electric currents is limited to the time *prior to rupture* when conservative measures are deemed indicated. From whatever point of view the advocates of the knife as the "ideal treatment of ectopic gestation" may present their claims it is quite certain that some patients will prefer the safe and almost certainly effective methods of galvanic or induction currents. It is necessary therefore to describe the technique in full.

Galvanic.—The absence of any urgent need for immediate operation is sufficient warrant for the employment of galvanic electricity. If the diagnosis proves to be a mistake there is nothing with which the condition could be confounded that would be harmed by the electrical treatment, and but one thing (a tumor containing pus) which would not derive benefit from the methods employed to cause the absorption of the tubal mass. The objections therefore to electricity could hardly be less, and since it composes the nervous system of the patient and relieves pain at the same time it is silently attacking the tumor, without causing any of the alarming disturbances and fears that often accompany grave surgical operations, the employment of this agent is indicated by regard for the patient's welfare. It passed beyond the experimental stage nearly ten years ago.

Place the patient in the dorsal position in bed, with the limbs flexed and knees apart, so as to afford the operator free access to the vaginal cavity. If the patient is in a nervous

and hypersensitive state administer a hypodermic injection of morphine. Also irrigate the vagina with a cleansing solution if convenient, although this is not absolutely necessary. If digital examination reveals great tenderness it should be allayed by a ten-minute application of *vaginal bipolar faradic sedation.*

Carefully insert the vaginal bipolar electrode in the usual manner and begin the dose regulation with the 1,500 yard No.

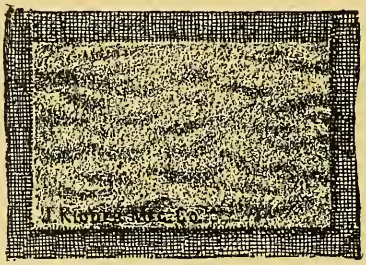


Fig. 180. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

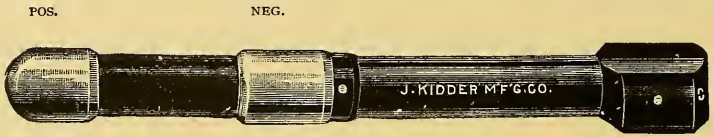


Fig. 181. Bipolar vaginal electrode.

36 coil, the rapid vibrator and four cells in circuit. Increase the dose from zero until the current produces a comfortable sensation with increasing relief to the patient. This may in one case require a 1,500 yard coil with less than the E. M. F. of four cells or in another case may require the 1,000 yard coil No. 36 wire, or even 800 yards of No. 32 wire with E. M. F. of between three and four cells. To ascertain the correct current strength is the work of a moment only. The sedative-tonic current should be applied for about fifteen minutes.

Next saturate a felt-covered, flat electrode, 7 × 10, in the invariable hot-water solution of bicarbonate of soda, press it only

moderately dry, and apply it to the abdomen directly over the site of the tumor. Connect it with the negative pole of the galvanic battery.

Wrap the carbon ball electrode with a mass of protecting absorbent cotton as large as can be comfortably inserted in the cavity. Saturate it in the same bicarbonate of soda solution and insert it through a speculum, allowing it to retain as much moisture as possible, for the wetter it is, the better con-

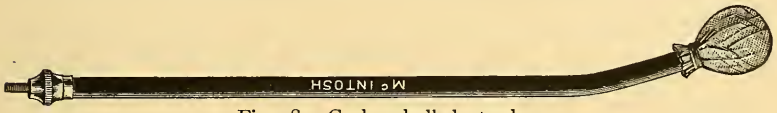


Fig. 182. Carbon ball electrode.

ductor it is. Support it gently against the tubal mass and connect it with the positive pole.

Gradually increase the constant galvanic current from zero until the meter registers about 50 mil., if the tissues are not intolerant of this dosage. Maintain the maximum current for at least five minutes, and if it is perfectly comfortable to the patient continue it for eight minutes. Then gradually reduce to zero and close the first sitting.

Repeat the same applications on the second day following with a dose of 60 mil., and if no evidences of any impending rupture have appeared close the second constant current application in the following manner.

After reducing the current to zero switch the slow interrupter into circuit (if the apparatus contains one) and again increase the current strength from zero until contractions are felt by the patient. Do not make them so strong as to cause discomfort to the patient or incur risk of rupturing the sac, although the action of the galvanic current is not likely to do this. Extreme violence is not required, however, and the ordinary rules of careful dose regulation apply here.

The rate of interruption should be from 50 to 70 per minute, and if the switchboard possess no automatic rheotome the operator may interrupt the current by hand. One or two

minutes is sufficient time to employ the interrupted current at first.

Repeat exactly the same applications two days later, and if the tissues develop an increasing tolerance the constant current should be increased to fully 75 mil., although the regulation in each individual case must be directed by medical judgment.

After about six applications the prognosis in the case will determine the course of future treatment. After the patient is convalescent and requires only symptomatic treatment, this will mainly depend upon the local indications, but the chief resources will be bipolar faradization and vaginal, or, possibly, intra-uterine positive or negative galvanic currents.

Faradic.—Although every physician should have a galvanic apparatus, yet in case a faradic current is the only one accessible, it may be employed as follows:

Place a well-moistened felt-covered, flat electrode, 6×9, upon

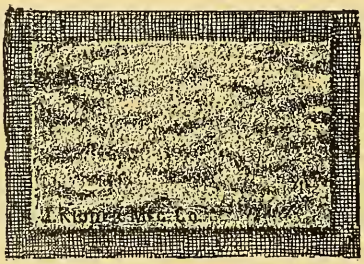


Fig. 183. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

the abdomen over the site of the tumor. Connect it with the positive pole of the high-tension induction coil apparatus. The negative electrode may be either inserted in the vagina or in

Fig. 184. Curved vaginal electrode.

the rectum behind the tumor. The choice of these situations depends on the situation of the mass. Employ the one which will bring the current most directly in contact.

Switch the 500 yard No. 32 and entire No. 21 wire coils, the rapid vibrator and four cells into circuit. Gradually increase the current strength through the rheostat until it is perceptibly felt at the internal electrode. After about ten minutes reduce the current to zero and close the sitting.

Repeat on the second day, and if no signs of threatening rupture have been discovered, add to the ordinary action of the current a few strong single contact impulses made in the following manner:

With the current strength raised to its point of maximum tolerance switch the cells abruptly out of circuit; then switch them suddenly in again, and repeat this manœuvre about thirty or forty times during the last minute of the application. This produces an effect similar to that of a slow interrupter, which may be used if desired.

The faradic current is not so effectual as the galvanic current, and before employing vigorous interruptions it should be determined whether or not the sac is so tense that stimulation of muscular action would endanger safety.

As the majority of physicians could employ either of these methods even if they were without facilities for a laparotomy, and as in some cases the patient would be subjected to a greater tax simply to recover from the surgical operation than the entire electrical treatment would involve, there is abundant argument as to which method to advise during all the very early period of extra-uterine pregnancy and prior to impending rupture.

For the permanent re-establishment of general health when absorption is safely progressing and the patient stands in need of tonic and nutritional remedies, the static machine and vaginal bipolar faradization are both of great utility. Every physician who understands the general applications of these methods will find them invaluable. They are to be em-

ployed according to the rules laid down under special headings.

Remarks.—Although so many cases of the satisfactory treatment of extra-uterine pregnancy by both galvanic and faradic currents have been reported in medical journals during the past ten years, I will cite an instance of each method so that the reader may have before him a clinical example for reference.

Tubal Pregnancy Treated by Galvanic Currents.—Mrs. E——, aged 33, mother of two children, aged five and one-half and three and one-half years. Last regular menstruation, March 22. April 23 to 30, flow absent, slight nausea, repeated severe colicky pains in lower part of abdomen, especially on right side.

May 1. Uterus of normal size, slightly retroverted, external Os somewhat small and slightly patulous. To right of fundus a small tender mass, taken at the time for a partially prolapsed and probably inflamed right ovary. Excessive tenderness prevented a thorough search for the right ovary in its normal position.

May 5 to 13. Metrorrhagia more free than at periods, accompanied by colicky pains and the discharge of a few small shreds. Tubal pregnancy strongly suspected. Hemorrhage controlled by tamponing vagina with iodoform gauze.

May 13 to 21. No further hemorrhage, but persistent colicky pains, and pains down anterior part of right side. Daily examination showed mass to right of uterus to be steadily and rapidly increasing in size. A positive diagnosis of tubal pregnancy of the right side was now made, based upon the following consideration:

1. The symptoms of an incipient gestation. 2. The development and rapid steady growth of a tumor in the region of the right tube where it was positively known that nothing abnormal had previously existed. 3. The accompanying metrorrhagia, labor-like pains, and the passage of shreds.

On May 22, while returning from the office of a consultant, the patient was suddenly taken with the most excruciating abdominal pains, fainting, vertigo, and symptoms of collapse. Her pulse became rapid, small, and thready, and her countenance blanched. After reaching home with difficulty, a hypodermic of 15 minims. of Magendie's solution was followed by cessation of pain and an improvement of general symptoms. Electrical fœticide was agreed upon by the advice of Dr. T. G. Thomas.

May 23. (The electrical administration with the galvanic current was rather crude and inferior to that described by the author above, and need not be repeated here in detail.)

The applications were repeated on May 25, 27, 30, June 3 and 6—six applications in all. During this time the patient suffered much from pains in the lower part of the abdomen, more of a quiet and steady character than of the previous colicky nature, and accompanied by a slight rise of temperature ($100\frac{3}{5}°$) and pains and soreness in the abdominal muscles. The latter I attributed to the violent contractions produced by the electricity. The pains on two occasions called for hypodermics of morphine for their relief.

(The application reported was unnecessarily violent and was not preceded or followed by bipolar sedation, hence disturbances resulted which were the fault of the operator.—AUTHOR.)

June 15, menses reappeared, normal in duration and amount, and painless.

Cessation of the growth of the tumor was verified by examination.

November 21, patient has remained perfectly well since June 6.

On two occasions excessive exertion was followed by dull pain in the right groin lasting for one day. With this exception there has been absolutely nothing to remind her of her former trouble. Examinations at intervals have enabled me to follow the gradual diminution in size and the final disappearance of the mass without any further treatment.

To-day nothing abnormal can be found in the pelvis by bimanual examination. I report the case because the diagnosis, carefully and deliberately arrived at and confirmed by two eminent authorities, cannot reasonably be questioned, and because of the entirely satisfactory results of the galvanic treatment—destruction of the fœtus and its complete absorption within six months, without having exposed the mother to the perils and possible sequelæ of a laparotomy. (*Edebohls.*)

Tubal Pregnancy Treated by Induction Coil Current. Mrs. S——, aged 23, one child four years previous. First examined by me on September 24.

She had complained since August 12. Menstruation should have occurred on the 12th, but was deferred until the 14th, when there was a slight show, which ceased after two days, to reappear, but only as a stain, through the remaining days of August and up to September 19th. She had just previous to this last date made the journey to town, about twenty miles. The flow stopped two days and again began.

Besides the protracted inconsiderable flow, the patient suffered from constant heavy pain and tenderness in the lower part of the abdomen, chiefly in the left inguinal region.

My partner saw Mrs. S—— at her country home, August 27th, but she declined to have an examination.

September 8th, the date of menstrual epoch, she had, as she described it, a dreadful attack of pain, accompanied and followed by abdominal soreness, but no increase of flow.

September 11th, she had another very violent and persistent attack of pain. To her friends she seemed almost in collapse. "She looked like a dead person, deep circles under her eyes, and her face drawn and pinched, with cold forehead, nose and chin."

September 14th, she was removed to town, and was seemingly somewhat improved.

September 24th, late in the evening I was called to see Mrs. S——, and found her in pain, which to my judgment was very intense, though said to be less severe than previous ones. It was relieved by the hypodermic needle with morphia; and I made a vaginal examination. This showed the uterus to be in right retro-latero version, moderately fixed, and slightly enlarged. Save the slight enlargement, the condition of the uterus was the same as at the previous examination.

On the left side lying low down, but easily separable from the body of the uterus, I could by the bimanual method readily define a semi-fluctuating tumor, in size and shape like the bulb of a Davidson's syringe, perfectly movable, but exquisitely tender.

This was described as the site of all previous pain and soreness.

I recognized it as a probable, extra-uterine tubal pregnancy. This I must confess had not, until this examination, occurred to me as the condition likely to be found.

Inquiries made after this vaginal examination brought out the facts of quite constant nausea during the month of August, and the breast signs were also those of pregnancy.

I much desired a consultation, but I was afraid to have it, for I feared that I might risk my patient's life were surgical treatment adopted. I determined to delay at least a day or two, treating the patient and holding the surgical procedure in reserve. The sac, though very tender to touch, did not seem so tense as to excite alarm that it would burst at once. I waited for Dr. T. G. Thomas, who was out of town, thinking he would agree with me in methods to be used.

September 25th. With the patient on the back, brought to the edge of the bed in the French obstetric position, I intro-

duced a metal ball electrode into the rectum, just beneath the tumor, and passed a current from a Kidder faradic battery through the tumor. The positive electrode was a broad sponge placed on the abdomen just over the tumor. The current was used for fifteen minutes, and was well borne by the patient.

Electricity was employed in this manner each day for five days.

September 26th, the day after the first application, the patient had no recurrence of severe pain, and felt relieved from the general abdominal pain.

September 28th. She had a little pain. "But of a different character."

September 29th. The facial expression has markedly changed, the anxious look has gone.

October 2d. Dr. Thomas saw Mrs. S—— with me, and said the diagnosis was undoubtedly correct.

I used electricity October 1st, 4th, 9th and 13th.

After the first application of the coil current there was no increase of size of the tumor, but I could not appreciate its decrease until October 20th, when it was markedly smaller.

There was uterine discharge till October 20th, this was shreddy. It was not further examined.

I report this case because it shows the efficiency of the faradic current in destroying the misplaced fœtus, and arresting sac-growth. Many a physician has a battery, and skill in its use, who has not the ability to do a successful laparotomy.

If the electrical current is effectual, it is without hazard to the mother, and in trying to do good it is most desirable not to do harm.

At my last examination no remaining trace of the tumor could be detected. (*Walker.*)

CHAPTER XXVII.

OBSTETRICAL USES OF ELECTRIC CURRENTS.

Pregnancy as a contra-indication for various electric currents. Uterine inertia in parturition. A clinical case illustrating three methods of faradic application. Indications for the faradic current during labor. Baird's method. Post-partum hemorrhage due to atonic state. Involution. Discussion on electricity in obstetric practice. Super-involution with amenorrhœa. The induction of premature labor. Post-puerperal metritis. Post-puerperal discharges. Phlegmasia alba dolens.

Pregnancy as a Contra-Indication for Various Electric Currents.—While much alarm has been expressed by theoretical writers over the dangers of employing electric currents during the pregnant state, yet all experienced operators become aware in the course of time of the fact that there is only a very remote liability of harm to the mother or the child, unless the application is deliberately made and the technique directed to the destruction of the fœtus.

Almost all the rational administrations of therapeutic currents from improved apparatus are about as likely to be safe and beneficial to the sufferer during gestation as to the victim of disease who is not pregnant.

During the first three months of pregnancy, apart from general applications, I regard the sedative-tonic effects of vaginal bipolar fine wire faradization as not only safe but beneficial and as good practice whenever indications for its use exist. No expert physician will be at all likely to produce harm by this method. It is extremely useful to allay nausea, reflex irritation and even the spasmodic contractions of a threatened miscarriage.

About the year 1860, Tripier of Paris introduced the bipolar electrode and vaginal bipolar faradization. Since that time

both the construction of electrodes and improved coils have increased the advantages and usefulness of this method. Induction coil currents are also passed through the pregnant uterus by monopolar methods for various therapeutic purposes, and after an experience of great extent, covering a period from 1859 to 1893, Tripier writes the following statement: "When I began these trials I admitted with others that when a gravid uterus received faradization a miscarriage was brought on; this is not so, however, as can be verified."

Any local applications of the galvanic current either external or vaginal in mild dosage and which do not invade the uterine cavity with an electrode may be safely made by any careful therapeutist.

General faradization and central galvanization, including all ordinary external uses of these currents for local or general diseases outside the pelvis, and especially when applied for the relief of pain, may be considered safe practice.

If they are employed with sufficient skill to do good in any ordinary case they will do about the same good during pregnancy and are practically free from the liability of harm in the hands of any trained physician.

It is a number of years since any writer of note has ventured to repeat the ancient superstition that electricity unfitted the uterus for pregnancy. The contrary is so indisputably the fact that ignorance itself has withdrawn the puerile charge of early days, but appreciation of the value of rational electrotherapeutics during the various indications of pregnancy remains to be developed among the profession at large.

In the first three months of pregnancy I regard the sedative-tonic effects of static electricity as not contra-indicated in any reasonable form of administration which is necessary for the treatment of other conditions of the patient.

All administrations of static, in the form of general electrification, breeze and spray, are safe and beneficial at all times during the entire course of pregnancy, whenever and wherever they are needed. They cause no muscular contraction, and

no untoward occurrence that might appear to be coincident could be attributed to them.

Powerful sparks in the region of the pelvis would not be applied during any stage of pregnancy except for good cause, by one accustomed to every phase of static electricity, although as a matter of fact I have never seen them do any harm in any case, nor do I believe that it would be possible to produce a miscarriage by rational therapeutic measures with this agent. Sparks may be applied to the rheumatic joints, myalgic muscles, and neuralgic pains with the same good results and absence of harm that they are applied to non-pregnant women.

Static electrification, positive or negative, and the positive breeze and spray, are not only as safe and beneficial as sleep itself when they are indicated in pregnant women, but more than any other sedative-tonic within the range of medicine a skilfully handled static machine will conduct them comfortably through the functional disturbances of gestation.

The head breeze will remove for the time any headache that does not demand mechanical support to a dragging uterus for its relief. The mental states are comforted in the same way. The backaches are wholly removed as often as they recur by the spray and milk spark. Nausea often vanishes during general positive electrification and especially after a positive breeze over the region of the solar plexus. General nervous disturbances are controlled in the same manner, and for some time after such a treatment the patient feels like a new being.

I have seen a woman in the third month of pregnancy step upon my static platform in such a state that it would be the despair of a medical prescriber to select a remedy that would enable her to become fairly comfortable without regard to time. In fifteen minutes she has spontaneously declared that she "felt made over new," had lost the nausea, repugnance at the mere thought of eating, severe lumbar pains, numbness in both upper and lower extremities, headache and depression in spirits, creeping chills, and has gone from the office directly to the dinner table and enjoyed a hearty meal.

Such amelioration is not limited to a few moments after the treatment. It sometimes lasts but a day, while in other cases the patient continues to feel comfortable for one or two or more weeks. But after one experience with such an agent, with its demonstrated power to comfort her condition, she never again fails to turn to it for relief when occasion requires.

If frequently administered during the latter part of gestation it will act as an efficient tonic and nutritional stimulant, and aid in meeting the trials of parturition with unshattered nervous forces and unimpaired muscular strength.

In relieving the pains, discomforts and conditions which interfere with nutrition and sleep in the last month of pregnancy the static machine does for a suffering woman what nothing else can do to tide her over the crisis.

It is well to say also that electrical tonic sedation often so far outclasses the effects of bromides, and other hypnotics, anodynes and sedatives as to displace entirely their routine use in the practice of the owner of a static machine, to the unspeakable benefit of his patients.

Uterine Inertia in Paturition.—Employment of electricity for this purpose should usually be preceded by dilatation of the cervix. Until the cervix is either dilating or dilated, electrical applications are only indicated for sedative tonic effects.

After this preparatory step moisten a felt or sponge covered,

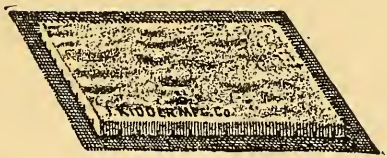


Fig. 185. Fine felt or sponge covered electrode.

flat electrode in hot water, place it under the lumbo-sacral spine, and connect it with the positive pole of the induction coil apparatus. Connect the negative pole with an ordinary

sponge-covered hand electrode about three inches in diameter. Moisten this in hot water, and lubricate it with a little soap.

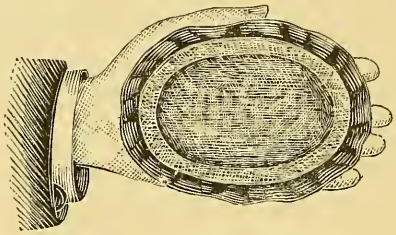


Fig. 186. Sponge-covered flat electrode.

Switch into circuit the rapid vibrator, the total length of Nos. 32 and 21 wire coils, and with the negative electrode upon the abdomen over the fundus of the uterus increase the current strength until a mild stimulation is effected. Promenade the hand electrode slowly over the different portions of the fundus until regular contractions occur, and then only *during* contractions. Increase the current strength until it is sufficiently vigorous, and yet not uncomfortable to the patient. Intermit the applications so that they are made to follow as nearly as possible the normal action of the uterus.

The management of the application must be governed by the progress made, and if effective stimulation sets up adequate natural contractions, the use of the current may be modified or suspended.

The following single case illustrates the results of three different methods of application:

Mrs. S——, mother of six children, had been having pains for twelve hours. Os soft and dilated, two inches in diameter, pains feeble. Finally, despite medical measures, the pains stopped and started again for three nights in succession, wearing the patient out, without result. A medium secondary induction coil current was then selected, an electrode placed upon each side of the fundus externally, and sufficient current strength employed to cause contractions of the upper segment. This, however, did not push down the head.

A vaginal electrode was next placed internally against the cervix, while the other electrode was held upon the fundus externally without success.

A third trial was made, placing both electrodes externally with the positive under the sacrum, and the negative on the fundus. Passing the current directly through the pelvis in this manner, effectually aroused the uterus, and contraction became frequent and strong. During a ten-minute application the Os dilated rapidly. Labor was completed in less than one hour after the first application of the current. (*Hyatt.*)

In the hands of those who speak from successful experience the sedative or sedative-tonic and stimulating variations of coil current applications during the different stages of labor subserve the following purposes:

To modify the pains of labor.

To favor a more rapid dilatation of the Os.

To promote more vigorous uterine contractions.

To add tone and strength to all the muscles engaged, and increase their power of doing work.

To abridge the time occupied by the labor.

To prevent shock, exhaustion, and post-partum hemorrhage.

To insure contractions of the uterus in cases of instrumental delivery.

To arrest hemorrhage and accelerate labor in cases of placenta prævia.

To prevent an undue expenditure of nervous force in all cases of debility from whatever cause, thus leaving the patient in a condition to secure a speedy and favorable convalescence. (*Baird.*)

From a personal experience in the employment of an induction coil current in 220 cases, Baird has the following to say about methods of application. The chief are:

1. One electrode in the vagina and the other over the fundus.

2. Both electrodes externally over the abdominal parietes.

3. One electrode on the sacrum and the other on the abdominal parietes.

The above, and other methods found successful by various writers, all include the uterus and its nerves within the circuit. Method No. 1 (adopted by former writers) is open to the great objection that in some cases it will bring the electrode in too close proximity to the head of the child. Never make the application in such a manner as to include the head of the fœtus in the circuit in any case where its welfare is to be considered.

No. 3 is a very safe and effective manner, as I can testify from its use in over two hundred and twenty cases, but if I should ever encounter a case in which this method failed I should then adopt method No. 2.

Playfair says: "Uterine manual pressure is the best and safest oxytocic." I consider it an improvement on Playfair's measure to have the hand that makes it form one electrode of a good and reliable induction apparatus. The same manipulation and the same pressure can be made with it as though it was unconnected with the apparatus. In cases of uterine inertia I have never failed to quickly excite vigorous uterine contraction by this method, and often with refreshing and restorative effects upon the patient.

As soon as I deem it necessary to make the application I

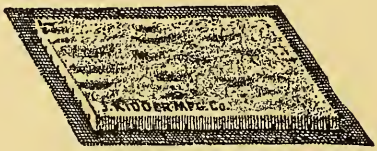


Fig. 187. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

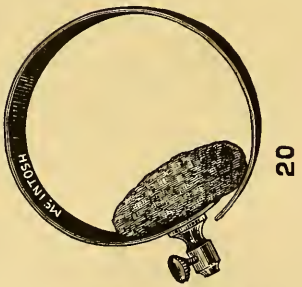


Fig. 188. Self-retaining wrist electrode.

do so in the following manner: Place the patient in the dorsal position. Moisten a felt or sponge covered, flat electrode, three inches wide and six inches long, connect it with the positive pole of an improved induction coil apparatus and place it under the lumbo-sacral spine in the direction of its axis. Connect the negative cord to a wrist electrode and apply it to one of the wrists, moisten the hand with warm water and apply it to the abdominal parietes. Switch into circuit the rapid vibrator and the combined primary and short wire secondary coil. Do not begin with a strong current, but gradually increase the dosage until it has a pleasant and soothing effect upon the patient, or is as strong as the operator's hand will bear.

Make the application with the hand continuous until a sufficient amount of sedation is produced (from five to thirty minutes), then remove the hand during the interval between pains and manipulate the uterus again when the pain recurs. After all reflex pain has been subdued and the patient rests well in the intervals, only keep the circuit closed during the time occupied by the rhythmical contractions of the uterus.

By this means I am able to determine the exact condition of the uterus and to note correctly all the changes which may occur in its contour, and I can also estimate the amount of increase which occurs in its contractions, and I am also enabled to perform uterine manual pressure, and if it is necessary to use both hands for this purpose it can readily be done, and each hand then conveys the current to or from the uterine walls.

By an intermittent application we are effectually guarded against the danger of destroying the electro-muscular contractility of the organ which we wish to stimulate and strengthen. I have used it in this manner in tedious labor for twenty-four hours and during all this time it furnished to the nerves and muscles all the elements of increased *strength* and *rest*, as was fully evinced by the ability of the patient to withstand her pains, and by her earnest desire, often reiterated, "not to allow her to have a pain without closing the circuit."

With each recurring pain change the location of the electrode so that all the muscles engaged may be brought directly under the influence of the current.

As soon as I wish to facilitate the labor at the beginning of the second stage I use a current of as much force as the patient can bear with comfort, and in practice it will be found that the stronger the current used in this stage, short of producing spasmodic contractions of the abdominal muscles, the better it will suit the feelings of the patient.

After the perineum is well dilated, I moderate the force of the current, and in cases where I have any reason to apprehend danger to the integrity of this structure I withhold it entirely for a few minutes prior to the escape of the fœtal head from the vulva, so as not to hasten unduly the labor at this stage, and to give ample time for its full, free and safe dilatation.

As soon, however, as the head escapes, I direct the circuit to be closed *most* of the time until after the completion of the third stage of the labor, which in nearly all cases occurs with but little or more assistance in a very few minutes.

In all of my cases in which I have used it, the placenta has been expelled in from one to ten minutes from the birth of the child, with very slight or no traction upon the cord. This I regard as more simple, far less painful, and fully as speedy and efficient as Prof. Crede's method.

Baird collected the entire bibliography of this subject and formulated the indications. He concludes his own important contribution to the *American Journal of Obstetrics*, in the following manner:

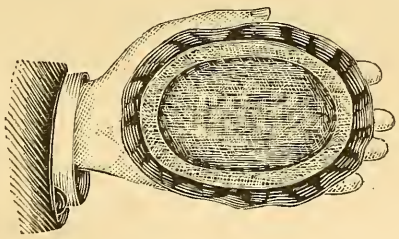
"It only remains for me to say that as an exytocic, to promote uterine contraction and facilitate labor in all its stages, all that has been quoted from our best writers in its favor *is true*. When I say that upon my approach to the bedside of my patient and have found the Os dilated barely enough to admit the point of my index finger, that I then make an application of the faradic current, and that it promotes contractions of the longitudinal and oblique muscular fibres of the uterus, thereby rapidly dilating the Os; that in one hour the second stage of labor is ushered in, and that in thirty minutes more the third stage had been completed—and I adhere to the statement that the rapidity of the course of labor was due to the measures adopted—this reflection consoles me, namely: That if my reader will attach any importance to my statements, and will faithfully follow in my footsteps, he will cheerfully sustain me in all that I have claimed.

I am fully aware of the fact that any physician who has enjoyed even a moderate amount of obstetric practice can readily refer to cases in which he has observed the same happy results, in which no measures were adopted to facilitate the progress of the labor; and I am also aware of the further fact that he can with equal readiness refer to a *far greater number of cases* in which he would, at the time in which they were in progress, have cheerfully been willing to have made almost any

personal sacrifice for the use of a reliable oxytocic; one which would have rendered him service at any stage of the labor. When his patient suffered from pains not only ineffectual, but rapidly exhausting her nervous forces; when her increasing anxiety and distress acted like a contagion upon the friends of the household; when precious time hung heavily upon his hands, and he was unwillingly compelled to witness sufferings which he had no power to control or abate; when from his ripened experience he *knew* that this undesirable condition of affairs would not only continue for an indefinite number of hours, *but was certain to grow worse;* when every recognized measure had been faithfully carried out; when there was nothing left for him to do but to apply 'uterine manual pressure,' as the safest and best oxytocic, at the risk of impressing her with a deep conviction that her condition was full of peril—what would he then have given if the hand with which such a pressure was made formed one electrode of a good, reliable induction apparatus, especially if the vitalizing current from it furnished a sedative force to every sentient nerve involved, a stimulating force to every motor nerve, and to every muscular fibre engaged? If this new force, this sensible increase of power, gratefully recognized as such by the patient, soothed her pain, refreshed her muscles, restored her strength and waning confidence, would not the physician, from the very depths of a thankful heart, have been ready and willing to exclaim: 'Electricity stands unrivalled as an exytocic'?" (*Baird.*)

Post-partum Hemorrhage due to Atonic State.—In a case of this kind intra-uterine interference may be wisely reserved and the routine recommendations of obstetrical text books may be considered subordinate to the prompt and simpler action of electric currents.

1. Place an ordinary sponge or felt covered, flat electrode,



POSITIVE.

Fig. 189. Sponge-covered flat electrode.

about the size of the palm of the hand, beneath the sacrum and connect it with the positive pole of the portable induction coil apparatus which every obstetrician should consider as much a part of his equipment as a pair of forceps. Connect with the negative pole a sponge-covered hand electrode and promenade it slowly over every portion of the abdomen over the fundus making *firm pressure* down upon the uterus. Both

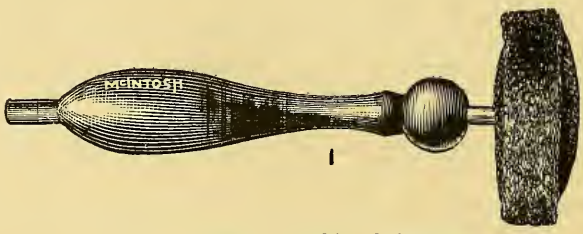


Fig. 190. Sponge-covered hand electrode.

electrodes should be moistened with hot water and the hand electrode lubricated by rubbing it two or three times over a cake of toilet soap.

Employ the rapidly interrupted current from the combined No. 32 and No. 21 wire secondary coils and quickly increase the current strength from zero until it produces effective contractions, which should, however, be without discomfort to the patient. If the uterus does not at once respond, scarcely a moment need be lost before employing the next and more active method.

2. A large intra-uterine bipolar electrode with a long hard rubber insulating handle should also always be carried. In any rare and desperate case in which the foregoing method is not effective instantly transfer the conducting cords to the bipolar electrode, sterilize this and instantly insert into the uterus to the fundus. Quickly increase the current from zero until it contracts down the uterus. Owing to the liability of carrying external infection into the uterus this method should be reserved until it is rendered necessary by the failure of the external application, which is always safe.

The "hot douche, ice in the vagina or uterus itself, astringent preparations and vinegar, flagellation with a cold wet towel," are time-honored remedies which engage the close attention of the student in every medical college. In practice the coil current outvalues them all. It is the hemorrhage of atonic vessels from over-distension, anæmia, collapse, or any form of muscular atony which contractions arrest, and bleeding due to lacerations of the cervix do not come under this category.

If any portion of the placenta is retained to keep open the mouth of a bleeding vessel it is obvious that prompt removal must precede success with the coil current.

Speaking from the experience of forty-one years Nunn recently said:

"*In atonic post-partum hemorrhage the effect of the application of the current is magical, and the control of the bleeding is rapid, complete and absolute.*"

See also Chapter No. XVII. on menstrual derangements (BLEEDING STATES OF THE UTERUS) for further experience with faradic currents in hemorrhage.

The greatest sphere of usefulness of electricity in obstetrics, it seems to me, is after the close of the third stage of labor, after the uterus is empty, where atony exists, and where we are afraid we shall have post-partum hemorrhage. I think the greatest and highest use to which we can put electricity in our practice is in those cases known as subinvolution following a bad getting-up from confinement, where the uterus is flabby and soft and bleeds easily and is apt to get displaced. There I think is where electricity comes in and will often produce marvellous results. From such experience as I have had I am exceedingly well satisfied in regard to the benefits that accrue from electricity in this class of cases. I am sure that I am able to get the most salutary effect upon the lining membrane of the uterus, and also promote absorption and diminution in the size of the uterus by employing a bipolar faradic current of high tension. The ligaments strengthen and in every way the results are all that could be desired. (*Danforth.*)

Involution.—*Faradic.*—The tendency of patients to "get up

too soon" after confinement retards the process of involution and makes chronic invalids out of women who would otherwise be well. The process of involution can be aided by the attendant physician during the time the patient remains in bed by daily applications of an induction coil current. Intrapelvic interference is not desirable, and the electrode should be applied externally.

Place a felt-covered, flat electrode, 4×6, under the sacrum and connect it with the positive pole of the portable high-

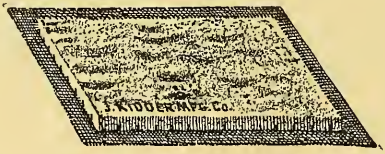


Fig. 191. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

tension induction coil apparatus. Press a negative sponge-covered hand electrode firmly upon the lower abdomen over the fundus of the uterus. Make deep pressure while the patient

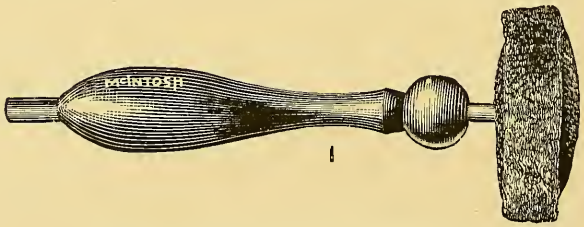


Fig. 192. Sponge-covered hand electrode.

lets out her breath until the electrode is in position and retain it in close contact.

Switch into circuit the No. 21 and No. 32 secondary coils, the rapid vibrator and four cells. Increase the current strength from zero until it maintains a strong contraction of the parts for ten minutes.

This simple but useful application can be employed in all cases which appear to require help or which progress slowly,

and in atonic cases the benefit will be marked. Even after the patient is up and about the applications can often wisely be continued three or four times a week for a fortnight longer, when, if necessary, the bipolar method can be used. The vaginal bipolar electrode may be employed as soon as the second week after delivery. The intra-uterine bipolar should not be used until the safer methods have completed their work, and only when the liability of sepsis is reduced to nil.

Discussion on Electricity in Obstetric Practice.—The following extracts from a discussion (September 1896) upon the value of a portable coil apparatus in obstetric practice will be suggestive to the general practitioner:

Dr. Nunn. To the obstetrician the faradic current is ordinarily used with a view to hastening processes delays in which involve danger to the patient. Such for example is the case in the electrical treatment of post-partum hemorrhage resulting from inertia which may be distinguished as *atonic* as opposed to that resulting from a physical lesion.

An application of the principles upon which the electrical control of post-partum hemorrhage is founded to the treatment of involution offers a fair prospect of benefiting the parous woman by reducing to a minimum the number of the days of her lying up, and lessening if not altogether suppressing the diseases consequent upon subinvolution and the persistence of a relaxed condition of the pelvic tissues. In cases having the characteristic want of tone, the lack of spring, the inability to recover from a disturbance either because the nerve power is wanting or the muscles will not respond, the faradic current will prove of the greatest service, and by its judicious use and the simultaneous employment of careful asepsis and the proper support it is possible to avoid entirely the usual lying up after confinement.

In a crucial test of these views in one case in practice (that of a multipara) the result was highly satisfactory, the patient remaining in bed but twenty-four hours after confinement and experiencing no suffering or inconvenience other than renewing a dressing twice daily for a few weeks, then gradually discontinued. In this case not only was there no suffering but the treatment proved to be most beneficial, as it resulted in the cure of a prolapsus which the patient had inherited from a previous confinement.

Dr. Morse. I have had some experience in using the faradic

current in ordinary cases of tedious labor and nearly always find it an aid in saving time and inducing powerful contractions of the uterus. The patients say that they can bear the pain better. It facilitates the labor all around. I arise to speak particularly of a case of subinvolution I had five or six days after confinement. The uterus was large, soft and bleeding. I tried various remedies without any result at all.

I applied the galvanic current, 100 milliamperes, with the positive pole in the uterus and the hemorrhage stopped almost immediately.

I then used the faradic current, one pole in the uterus and the other alternately over the sacrum and over the fundus, and the result was very marked.

For the last three or four years I have always carried a portable battery with me to save time and to save sleep. The patients I have used it with once and to whom I have gone a second time have always asked for it, saying that it gave them much relief.

Dr. Smith. I know a good many physicians who carry a small faradic apparatus together with their obstetric bag, and men have told me they believed they had saved more than one life by having it along, especially in cases of post-partum hemorrhage. I believe it is a means of arresting post-partum hemorrhage and also of helping uterine contractions when they are not sufficiently powerful. Of course quinine and ergot are other means, but the application of the faradic current to the abdominal wall is very simple and safe, and very speedy in increasing uterine contractions.

Dr. Dame. In addition to the use of the faradic current in post-partum hemorrhage I have used it in menorrhagia from atonicity. In many cases of excessive menstruation this treatment gives very satisfactory results. Subinvolution from any cause will readily yield to it. I have found it very useful.

Dr. Morse. I have a patient whom I have attended in three different confinements. On two occasions I have used the faradic current and she did not have any after pains at all. I have in mind several cases where I have used it previous to birth to produce more forcible contractions and did not have to use the customary remedies for after pains.

Dr. Smith. I can quite understand that. The after pains are supposed to be due to the presence of a clot in the uterus. Now we do not get a clot in the uterus when the contractions are good. It is when the contractions are not good that the hemorrhage takes place in the uterus and this excites the after pains to expel the clot. I can understand that when you use the coil current that you will get such good contractions right

after labor that there will be no hemorrhage and no clot to expel.

I wish also to report only the most favorable results from the use of post-partum bipolar faradization. It insures both vaginal and uterine involution promptly. I do not use it until the second or third week. (*Love.*)

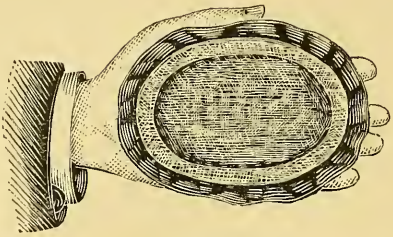
"At an adjourned meeting of the Paris Academy of Medicine, Dr. Apostoli read a communication on the above subject. He remarked that at present histology and clinical observation agree in attributing almost all cases of metritis and uterine engorgement to interrupted uterine involution. He, therefore, proposes as a prophylactic agent in an affection which so often follows labor the adoption of the following new therapeutic method. He thus expresses himself: A woman having been delivered, whether at full term or not, I immediately apply to her uterus a faradic or induction current generated from a coil made from a short thick wire, and of progressive intensity.

"In case of normal and full term labor, I renew this application eight or ten times within about six days. In case of difficult or premature labor, I repeat it fifteen or twenty times through a period of from ten to fifteen days. My object is to aid, hasten and perfect uterine involution, and thus avoid all the complications incident to slow or deferred convalescence.

"I propose the introduction in obstetrical therapeutics of uterine faradization in every case of labor: First, because it is a wonderful method, of easy application, readily controlled, rapid and energetic in its effects, always harmless and capable of being applied or discontinued at will; and second, because its immediate effects tend to restore the patient's health, while it ultimately guards against all subsequent uterine complications."

Superinvolution with Amenorrhœa.—*Faradic.*—This condition may be treated upon the same principle as amenorrhœa with an undeveloped uterus. The essential circulatory, muscular and nutritional stimulation is effected by the faradic current.

Place a flat sponge-covered electrode upon the back of the neck and connect it with the positive pole of an improved high-tension coil induction apparatus. Insert a sterilized



POSITIVE.

Fig. 193. Sponge-covered flat electrode.

electrode sound to the fundus of the uterus and switch four cells, the rapid vibrator and the 1,500-yard No. 36 coil into

Fig. 194. Intra-uterine electrodes.

circuit. Gradually increase the current strength from zero until the tolerance of the tissues is determined and continue the treatment with the particular coil which furnishes the necessary dose. Length of sitting may be fifteen minutes at first, if sedation is required to allay any local tenderness, but when more active stimulation is tolerated the time may be reduced to ten minutes. Repeat three times a week.

The applications may be made daily about the time that the flow should appear, as indicated by the symptoms of the patient.

When the periods are established the treatment should continue for several months with more or less regularity, and if the flow is not free after the nutrition of the muscular body of the uterus has been restored a few intra-uterine applications of a negative galvanic current, 20 mil., may be employed to stimulate the secretory function.

The Induction of Premature Labor.—Employment of electricity for this purpose should be preceded by local dilatation of the cervix by ordinary methods. Until the cervix is

either dilating or dilated, electrical contractions are not indicated. The methods to follow are the same employed in normal labor, and fully discussed in previous pages.

There is one point that the speaker did not mention that served me in a very trying case, and that is the induction of premature labor. I had a case this past winter—a lady who on previous occasions of confinement had been seized with very violent *post-partum* convulsions, due to uræmia.

The pregnancy was advised against, but the advice not taken. She presented herself later, pregnant, with all this terror ahead of her. A few of my friends were asked to consult with me concerning it, and we decided that we ought to produce an abortion. She had had five very strong convulsions, and nearly lost her life. We discussed the various means, and finally decided to use electricity. We used the induced faradic current. The application was made for one hour, one pole in the vagina applied to the cervix, the other over the abdomen.

There was little or no pain at the time, although there were some contractions of the abdominal muscles; but one hour afterward she had a slight show, and during that night or early the next morning labor set in quite actively, and she was relieved with very little trouble. The advantage to her seemed to be the avoidance of the risk of irritation and infiltration.

I know of one or two other similar cases where it was also used, although not in my hands, with equal success. (*Youngman.*)

Post-puerperal Metritis.—Whether involution is arrested by mere inertia or some form of infection it is certain that the process should not be allowed to become chronic. Recent subinvolution can be more successfully and quickly treated by an induction coil current than by any other means at our command.

First employ vaginal bipolar faradic sedation, and gradually merge this into tonic, and finally into stimulating applications

Fig. 195. A proper bipolar electrode.

as fast as the improvement increases tolerance. Daily sittings for a week are advisable, and treatment three times a week

should be continued until benefit is sufficient; or if more direct contraction of the muscular fibres is required during the latter portion of treatment, moisten a felt-covered, flat electrode, 5 × 7, connect it with the positive pole of the induction

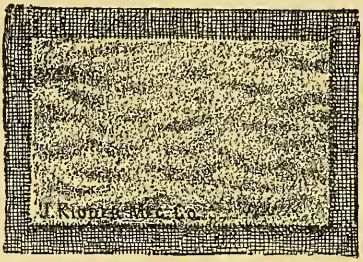


Fig. 196. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

coil apparatus, and place it upon the sacrum and lower abdomen in alternate sittings. Sterilize an ordinary intra-uterine

Fig. 197. Intra-uterine electrode—assorted size tips.

sound electrode, connect it with the negative pole, and insert it into the uterus.

Switch the rapid vibrator and three or four cells into circuit. Commencing at zero gradually increase the current strength from the coil which a moment's test determines to be adapted to the tolerance of the tissues. After maintaining the constantly even current for five minutes, produce strong contractions of the body of the uterus by either the slow vibrator, or by momentarily decreasing the resistance in the rheostat so that the current is increased suddenly, and as suddenly reduced

to the ordinary dosage. By this undulating method the maximum impulses produce very effective contractions.

The use of an intra-uterine bipolar electrode in these conditions is not very necessary nor very advisable, although it is recommended by some. It should only be employed by a practised operator and with special care.

Post-puerperal Discharges.—Sanguineous discharges continuing beyond the normal periods of their appearances, or returning during the first weeks after parturition, may be controlled in the following manner:

Moisten a felt-covered, flat electrode, about 5 × 7, in hot water,

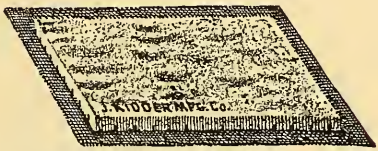


Fig. 198. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

connect it with the negative pole of the high-tension induction coil apparatus, and place it either under the sacrum or upon the abdomen. Sterilize an intra-uterine electrode-sound in the alcohol flame, connect it with the positive pole, and insert

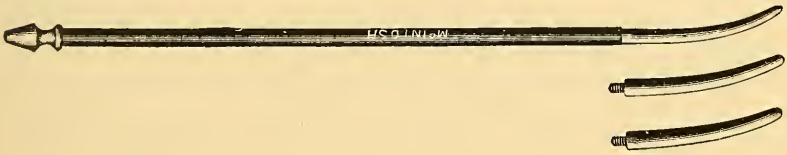


Fig. 199. Intra-uterine electrode—assorted size tips.

it with extreme gentleness into the uterine cavity. In these cases an antiseptic vaginal douche is a wise precaution.

Switch into circuit the rapid vibrator, about four cells and the 1,500 yard No. 36 coil. Gradually increase the current strength through the rheostat from zero until the proper coil

is selected, and the dose regulated so as to cause comfortable but strong contractions of the muscular fibre of the uterus. Maintain the current strength at the point of comfortable tolerance for about eight minutes. Gradually reduce to zero, and withdraw the electrode.

Repeat two or three times, as may be necessary, and if there has been no septic infection or injury to complicate the case, no other treatment will be required.

Phlegmasia Alba Dolens.—Moisten in hot water a flat sponge-covered electrode about the size of the palm of the hand, and for convenience, if the patient is recumbent in bed, place it under the sacrum where the weight of the body will

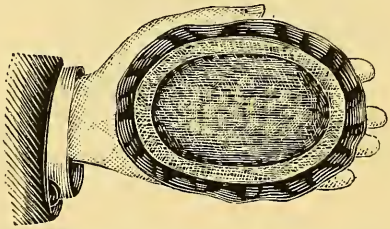


Fig. 200. Sponge-covered flat electrode.

keep it in firm contact. Connect this electrode with the negative pole of the high-tension induction coil apparatus. Moisten a medium-sized, sponge-covered hand electrode, ubricate it by rubbing it several times over a cake of toilet soap and connect it with the positive pole.

Switch into circuit the three secondary coils combining 500

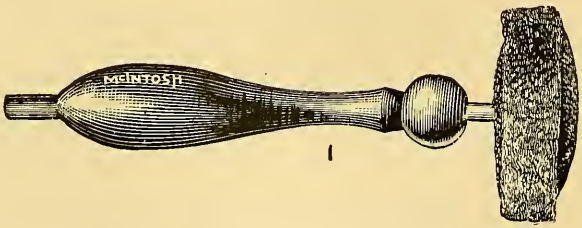


Fig. 201. Sponge-covered hand electrode.

yards of No. 36 wire with 800 yards of No. 32 wire. Adjust the rapid vibrator to very rapid and smooth action and employ three or four cells.

Place the hand electrode upon the anterior surface of the thigh and gradually increase the current through the rheostat from zero until it causes a perceptible and agreeable sedative grasp upon the tissues. After regulating the dose promenade the positive electrode over the entire limb from the hip down avoiding the sensitive parts of bony prominences about the joints and situations which do not require treatment. Fifteen minutes of this application will produce several hours of comfort. Repeat twice a day during acute stage and lengthen the intervals as improvement progresses.

Attention to the usual methods of treatment, action of the bowels, etc., is of course understood. The effect of the faradic sedation is both palliative and curative. If the limb is causing the patient great suffering the value of faradic sedation will be appreciated.

CHAPTER XXVIII.

TREATMENT OF VOMITING OF PREGNANCY, OR REFLEX IRRITATION.

Vomiting of Pregnancy or Reflex Irritation.—Both nausea and the tendency to hyperemesis in the early stages of pregnancy have been removed by simple static electrification to which I have sometimes added a sedative breeze over the region of the solar plexus. I have observed these ameliorations in patients who were neither taking any medicine nor being treated for hyperemesis. The fact that they were thus relieved has been reported to me after they had observed it with surprise. It is doubtful if this method would be effective in any aggravated case.

Vaginal bipolar faradic sedation for twenty minutes repeated daily has given relief in cases more obstinate. I have never observed any ill effects from this application, and my belief that it is devoid of danger in the hands of any physician who is competent to regulate the dose is supported by the statement of Tripier: "When I began these trials (treatment of uterine displacements) I admitted with others that when a gravid uterus received faradization a miscarriage was brought on. This is not so however, as can be verified."

In a more obstinate case there are several variations of method with both galvanic and induction coil currents which may be tested, and the one which affords the most relief employed.

Chief Method.—Seat the patient upon a chair with the clothing loosened about the neck and the abdomen. Connect two small electrodes about an inch in diameter with the positive pole of the galvanic battery by a bifurcated cord, moisten the covering with a hot-water two per cent. solution of bicarbonate of soda and press them upon the right and left pneu-

Fig. 202. Ordinary sponge-covered hand electrode.

mogastric on each side of the neck, above the clavicle and between the insertions of the sterno-cleido-mastoid.

Moisten a felt or sponge covered flat electrode, about 4 × 6, in the same bicarbonate of soda solution, connect it with the

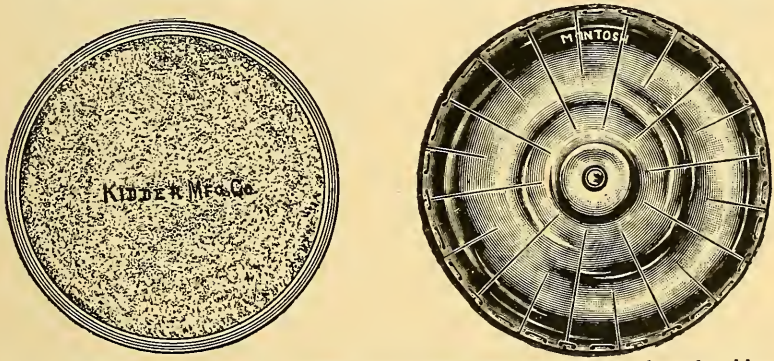


Fig. 203. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

negative pole and have it pressed over the epigastrium. Gradually increase the constant galvanic current through a rheostat from zero up to the *efficacious* dosage, which must be determined during each treatment. It may be usually 8 or 10 mil., but may be less and may require more.

Continue the application until relief is secured whether it takes fifteen or twenty minutes, or even more. In severe cases repeat after each attack or several times daily. As it often happens that food can be retained during the passage of the current which would be otherwise rejected it is good practice to administer the application immediately after eating when this is feasible. Valuable suggestions will be obtained by the reader who examines carefully the cases of Gautier and the remarks of Apostoli which are incorporated in this section.

Faradic.—Place a felt or sponge covered flat electrode about the size of the palm over the epigastrium and connect it with the positive pole of the high-tension induction coil apparatus. Place a similar electrode directly opposite on the back and connect it with the negative pole. Moisten both electrodes in the hot solution of soda-bicarbonate. For convenience the patient should recline in the dorsal position. The weight of

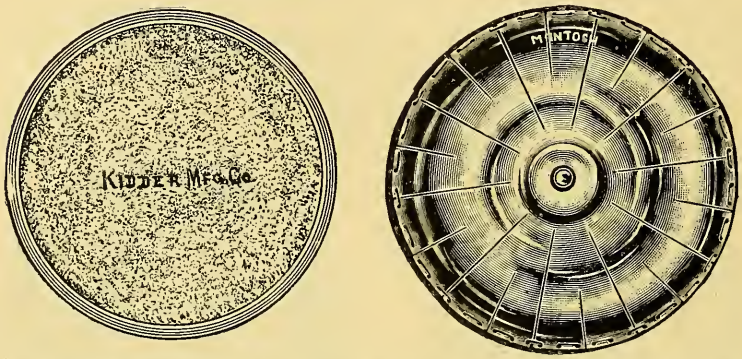


Fig. 204. Fine felt or sponge covered flat electrodes—assorted sizes with soft rubber insulating backs.

the body will then make firm contact with the negative electrode, and the positive electrode may be kept in place by either a small shot bag or the weight of the patient's hand.

Switch into circuit the rapid vibrator, three or four cells, and begin with the 1,000 yard No. 36 coil. Gradually increase the current strength by means of the rheostat from zero until it produces a strong but comfortable grasp upon the tissues. If the first coil selected does not produce sufficient current with the full E. M. F. of four cells, switch 800 yards of No. 32 coil into circuit and regulate the dose until the effect is produced. It will be borne in mind, as fully explained elsewhere, that the variety of coils affords the means of adjusting dosage to produce desired effects.

By the aid of one of these methods, in addition to regulation of the bowels, relief of constipation, and attention to the functions of the liver, there will be few cases in which the physician

will fail to obtain satisfactory results. The last method described is sometimes one of the most effective means to allay gastric irritability.

Drs. Gautier and Larat at quite a recent date have made an elaborate report upon the electrical treatment of nervous vomiting, from which the following is selected for the benefit of readers to whom the subject may be important.

Various treatments have been suggested for intractable nervous emesis, and in the long list of therapeutic procedures recommended, Pinard says that nothing can be prescribed today except with the idea that it *may* succeed. We believe that electricity is one of the most powerful remedies, if the methods and precautions are followed, which we use, and which were described by Semolla seventeen years ago. He has systematically electrified all his cases of intractable emesis, both hospital and private, and considers this treatment so infallible that he uses it for diagnostic purposes. The cessation is, he considers, proof of symptomatic vomiting, whether the organic lesion be in the stomach or elsewhere. In support of this theory he has published some very remarkable and constant results. Others have used a variety of methods with both galvanic and faradic currents, but their results have not been as constant or as rapid as those of Semolla, and we agree with him in thinking that galvanism, except perhaps in cases of hysterical vomiting, is infinitely preferable.

In all of our cases the vomiting has been stopped at the end of forty-eight hours, or at least decidedly ameliorated. The number of daily treatments, their duration and dosage can be given but approximately. In the following cases we give only those which have been followed by hospital physicians. Recently we have had the pleasure of successfully attending a case of vomiting in the wife of one of our confrères, which had been treated by all the usual methods without result.

CASE I. Mrs. K——, primipara; good health; menstruated regularly. Menses stopped January 8, 1895; vomiting commenced February 22. The patient could retain nothing, and vomited forty-five times in twenty-four hours, having violent epigastric pain and frequent fainting attacks. The second week the nights became bad, the pulse filiform. She then became pale and began to lose weight. Finally, an obstinate constipation was added. The vomiting became worse, and the insomnia was complete, with great physical prostration and cerebral excitement. Drugs had no effect.

Professor Dieulefoy advised increased doses of morphine, and, if these proved ineffective, the induction of abortion.

The case had lasted thirty-six days, and there was danger of death from inanition, when Dr. Champetier de Ribes, called in on March 25, advised electricity. The treatment was commenced that evening.

The patient was able to retain half a cup of milk, and felt better. About 3 A. M. she became worse again. The following day at 8.30 A. M. the treatment was repeated with the same results; but the pain, when it returned, was violent.

The third treatment was in the afternoon; the fourth in the evening. A continuous improvement commenced, the nausea becoming less, the pulse better, the constipation disappearing, while on the third day she slept without morphine. These treatments were given thrice daily for three days; then twice for five days. The patient could eat anything. The eighth day the cure appeared complete, but the treatment was continued once daily. On the sixteenth day she had regained her normal condition, and soon left Paris.

CASE II. Intractable vomiting and constipation of seventeen days' standing; continuous and abundant salivation. Mrs. De R., æt. forty; multipara; five sound children; good health; sixth pregnancy in October, 1894. Vomiting appeared following December. The patient could retain no food. All medication was vain. Morphine was given to induce sleep. Lavage was not tolerated. The sixteenth day the doctor (Dr. Champetier de Ribes) advised electricity. The patient at this time was pale and emaciated, complained of great fatigue with vertigo, a nervous erethism and insomnia, and had nausea day and night. She could retain only a little kirschwasser. Vomiting of bile; no stool for seventeen days. December 17, 20 ma. galvanization of vagus for twenty minutes. The resistance was noticeable. This diminished in subsequent sittings. The treatment was well tolerated, and a cup of bouillon retained. There was some nausea during the night and vomiting in the morning.

The morphine was stopped against the wish of the patient. December 18, two treatments, the — being at the level of the umbilicus, the + over the course of the vagus for fifteen minutes, and over the back of the neck for the same length of time. Nourishment, with but one vomiting attack during the night. The constipation was first touched on the nineteenth day after faradism had been given. On December 26 the patient is much better, retains food, bowels move, though a little salivation remains. The sleep is good. Thereafter but one daily treatment, until February 3, when it was stopped entirely, the patient being cured.

CASE III. Mrs. L. M——, twenty-three years old; married at twenty-two. In February, 1894, was troubled with vaginismus, which was ameliorated in six treatments with the alternating current. One pole was placed on the sacrum, the other in the vagina.

First pregnancy in March, 1894. Nothing particular for three months. At the end of June, however, the vomiting began, and was obstinate, in spite of lavage and medicaments. She could retain neither solid nor liquid food.

July 7, descending galvanism to the vagus enabled her to retain a glass of water. On the 8th, after two treatments, a cup of bouillon, was retained.

On the 10th and 11th, two treatments. Each is stopped at the end of ten minutes; the patient takes bouillon, and the treatment is resumed for five minutes. The sixteenth day the treatment was discontinued, and the accouchement in December was normal.

In this case a cup of bouillon caused distress for several hours, unless followed by the treatment. This is well illustrated by Case No. VIII.

CASE IV. The patient imagined that the tingling sensation at the electrodes helped her; so she was put on the current of tension. As she did not improve, galvanism was resumed, effecting a cure.

CASE V. Extra-uterine pregnancy. The galvanism controlled the vomiting up to the time of the operation, and assisted in the convalescence.

CASE VI. Patient did not vomit during first pregnancy. In the second, drugs were of no avail, but the condition was relieved in forty-eight hours by galvanism.

CASE VII. In a case of three months' pregnancy the emesis had lasted several weeks, and invariably followed the taking of any food. Vomiting, which could not be helped by the usual methods, was cured by galvanism in four treatments.

CASE VIII. On April 3 a case was seen which was pale, weak, emaciated. A cup of bouillon was vomited five minutes later. After the treatment she was able to retain it; in five days could eat meat, and in seven was completely cured, and remained so.

CASE IX. (Dr. Fourrier.) Two months' pregnancy; anorexia, nausea, emaciation, and prostration. Medication vain; the electric treatment rapid and complete.

CASE X. A little girl of eleven had nervous vomiting. Diagnosis uncertain; possibly hysteria, possibly uræmia (there were traces of albumen in the urine). Her condition was somewhat ameliorated, but she finally died.

CASE XI. Mrs. G., æt. thirty; had typhoid when seventeen, but made a good recovery; married at twenty-two; no children. Three years later she had a painful spot over the left eye and attacks of vomiting, having no apparent relation to her diet. This stopped after an external application of camphor and alcohol, with the exhibition of quinine. A year later the condition returned. The nausea persisted as long as the head pained. Still later she discovered that she was nearly blind in the right eye. An atrophy of the retina was diagnosed. Being treated by the method as above, she gained strength. Finally the other eye was affected; but, notwithstanding an undoubted cerebral lesion, the current controlled the vomiting, and, though nearly blind, she grew stout.

From these observations we draw the following conclusions:

(1) Descending galvanism over the course of the vagus, following the above method (long, small current, with frequent sittings), is a valuable treatment for vomiting.

(2) It is a curative remedy of the greatest value in the vomiting of pregnancy.

(3) In nausea due to grave, or even lethal, lesions of the nerve centres, this treatment either cures symptomatically or ameliorates considerably.

(4) The effect of this treatment is rapid, and it requires no adjuvant.

These remarks of Gautier were followed by a statement from Apostoli, published in the official bulletin of the French Electro-Therapeutic Society:

The galvanic treatment of vomiting has just received a new baptism before the medical society of the Parisian hospitals . . . . of which I could not but approve, were it not my duty to show, incidentally, the lapse of memory of one of the physicians, who seems to forget that in 1882–3 and 4 he has seen applied daily at each of my clinics the same procedure which he extols thirteen years later.

True, he has changed a single unimportant detail in the technique, but the rest is a perfect reproduction.

Vomiting occupies as a symptom a large place in pathology. Hysteria and pregnancy offer us typical examples which we can readily observe and study the respective value of the various medicaments used to control it.

In all works upon electro-therapeusis will be found more or less precise indications for the application of electricity in stomachic affections. Tripier formulated the galvanic thera-

peutics of vomiting, which I shall now discuss and call your attention to my modification of the operative technique.

On the 11th of August, 1882, I read before the Medical Society of the Parisian hospitals a note (based on twenty-eight favorable observations) on the electric treatment of hysterical gastric derangements (emesis, gastralgia), in which I extolled the descending galvanization + pole, of the right pneumogastric with a continuous current, of small quantity and of long duration.

Many previous experiments made at my clinic had demonstrated that the position of the other electrode was absolutely indifferent; therefore, simply on account of its ease of application, I have used the hand of the opposite side to close the circuit.

Shortly after, I applied the same therapeusis, with equal success, first in the vomiting of pregnancy, and then in a large number of gastric troubles, caused by various pathological stomachic lesions.

Moreover, I have, after a large number of comparative experiments, modified and improved my first operative technique, increasing its remedial action by galvanizing simultaneously the two pneumogastrics—but always with a small dose of long duration.

In August, 1884, I read a second paper, before the International Medical College, at Copenhagen, on the application of electricity to gastric derangements, and there treated at length the vomiting of pregnancy.

Since then, a practice of ten years has demonstrated the value of this technique, which I recommended in 1882 and perfected in 1884. Allow me to explain it to-day, by noting its important points and by substantiating it with my very complete experience.

Whatever the nature of the vomiting, whether it be hysterical or is connected with some gastric derangement, as that of pregnancy, for example, the operative technique is the same and consists of a number of minute details which must be carefully observed, for my practice has shown that, especially in grave and intractable cases, all the success of this method depends on their scrupulous observance.

In my first paper on this subject I have studied successively the nature, place and time of the applications, their dose, duration, and the number. I wish to explain again the chief points of formulating the rules which are attached to them.

1. Nature and Place of the Application.—In 1882, I repeat, I adopted exclusively the + galvanization of one of the pneumogastrics, and applied, always successfully, to the

right side. Later, some failures and parallel comparative experiments made me modify my first method, and I suggested the simultaneous galvanization of both vagi. It is this latter method, confirmed and strengthened by long experience, which I now recommend as being the most rapid, the most active and the easiest to apply.

It consists of placing two small equally-sized electrodes at the inner angle of the clavicles, at a point as near as possible to the trunk of the vagus.

As a matter of fact, it is the galvanization of this nerve at its most accessible place, and one which is easily found by the patient. Each electrode is placed about a centimeter from the end of the clavicles, grazing the upper surface of the bone, at the level of the depression which is left between the two heads of the sternocleidomastoid. Each electrode, usually held by the patient, should be small, about the size of a franc, in order to increase the density of the current at this level and to concentrate it *in situ*, that is to say, on the subjacent parts, including the vagus.

The electrode consists of a carbon button covered with gauze, conical or flat, according as a greater or less penetration is desired.

The current of the battery should be constant and all interruptions should be avoided. It is preferable to use a rheostat in order to avoid a shock, either at the beginning or end of the treatment.

II. THE DOSE.—The quantity of the current depends on the tolerance of the patient and the resistance to be overcome. There are two guiding rules: cure the patient; do not needlessly cauterize the skin.

The average dose varies from 5 ma. to 10 ma., but it is necessary occasionally to raise it—usually for an instant—to 15 ma. This is also done gradually and following the indications given by the patient.

The patient should be instructed to watch his sensations and tell the operator—particularly of nausea—that the quantity of current may be properly regulated.

Then by watching the meter and adjusting the current, all the fluctuations may be observed.

If, from the beginning, the current rises steadily to 5 ma. and the patient feels a considerable amelioration, all nausea disappearing, the limit is reached, for it is useless to increase the dose.

If, on the contrary, vomiting is immanent during the treatment itself, it is necessary to increase the quantity, immediately and rapidly, until one of two things occurs; either the patient

feels better, or complains of the burning. Then diminish the current, and run it up rapidly to about 5 ma. Then stop and increase it again at each sign of a return of the nausea prodromal of the next vomiting.

I believe that much of the success of galvanism in vomiting is due to the adaptation of the dose to the gravity of the evil, and certainly the variety is infinite, from simple, unimportant reflex vomiting to the intractable emesis which threatens the life of certain pregnant women.

It is to be remembered that women present a great difference of cutaneous sensibility, especially about the neck, and it is not wise to shock by an overdose which can provoke severe pain.

It is preferable, in the beginning, to keep to a medium dose, to acclimate them in a way, and to allow the moistening of the skin by the electrodes, with its consequent diminution of resistance.

III. THE DURATION.—The duration should be, as the quantity, proportioned to the gravity of the trouble, and, as a general rule, I say that no sitting should be ended until it produces an effect. It should then be continued until the patient says she is better, and not stopped until all nausea has gone and a normal condition been re-established.

It is therefore impossible to determine, as some of my predecessors have done, the duration of the treatment with mathematical exactness.

It is necessary to continue the application until the patient admittedly feels well, and has no desire to vomit. Further, it is necessary to be prepared to recommence at the first sign of a return for some time after the first treatment.

So from five minutes to an hour, with the time for resting, may be said to be the proper duration of the first treatment.

There is no necessity in the beginning of being discouraged. Only wait. The stomach, accustomed to vomiting, frequently commences by emptying itself. Often it has the characteristics of another attack. It is, therefore, necessary to wait until the patient says spontaneously: "I feel better, I do not think I shall vomit any more."

The average duration varies from ten minutes to twenty, and more, but it must be known that it can and ought to be continued much longer in some rare cases, and in these care must be taken not to scar the skin.

IV. THE TIME.—Galvanism having rather a curative than prophylactic action, it is better to treat during digestion to combat the dyspepsia, or the vomiting.

So the patient is made to eat, and the current, if applied then, will insure digestion and prevent emesis.

This indication is important, the vomiting should be immanent, and the spasm arrested; that is, the patient being put in a condition favorable for vomiting and the crisis averted, the pathological habitude of the stomach is broken as the pneumogastric irritation is calmed.

This is how I proceed:

First Time.—I make a preparatory treatment with a small current, for two or three minutes, the stomach being empty.

Second Time.—Without interrupting the *séance*, I make the patient eat, little by little, or drink that which is said to be the most apt to cause vomiting. I thus precede the difficulty by overcoming it step by step from the beginning.

Third Time.—I continue the current for a variable length of time after the ingestion of food or drink.

V. NUMBER OF TREATMENTS.—The treatments should be frequent at first, and in the beginning all digestion should be helped by the galvanism. Later, as amelioration is observed, the intervals are lengthened. Here, again, the variable personal element enters, and the method depends on the condition of the patient.

A single application may cure a case of intractable vomiting, though more frequently a second and a third will be found necessary.

The convalescent stomach often has a relapse, and it is wise to help it fulfil its function by several treatments, in order to prevent this.

Usually two treatments are given each day—one in the morning and one at night—particularly if the first was not a complete success, and a relapse should not be allowed.

In 1882, from eight cases, four of them intractable, I told how none had vomited during the first treatment, how some again in the evening and the next day, and that from one to eight treatments sufficed to effect a cure.

Later experience confirms this, and, especially in pregnancy, a relapse is equally well treated in the same way. To recapitulate, this is a uniform treatment which I systematized in 1882, and which I have used exclusively, and always successfully, hundreds of times for vomiting.

It consists of descending galvanism, or + pole, applied to the right, or, better, to both pneumogastrics, with variable dose and duration, and stops almost at once the derangement, be it epigastralgia, gastralgia or vomiting, in such a way as to leave beyond question the action on the vagus and its pathogenetic importance.

I would add that this proceeding has no effect on submammary, umbilical or ovarian neuralgias, and that its action seems limited to the gastric region.

Have I, then, caused some sort of a diathesis? No. The galvanism, given as above, stops a symptom; that is all. If a relapse occurs, it will stop it again.

Thus, by preventing the manifestation of a symptom—pain or spasm—a normal process is substituted for a morbid habit.

Finally, the continuous galvanic current, properly given, is the treatment for the symptom, whether it be dyspepsia, gastralgia or vomiting. If the symptom is purely reflex, as, for example, the vomiting of pregnancy, the action is immediate and supreme. In other non-carcinomatous cases it is extremely valuable as an active adjuvant to the classical therapeusis.

Graily Hewitt urges that a proper distinction be made between the vomiting of pregnancy which is produced by and directly dependent upon the condition itself, and vomiting occurring during pregnancy yet due to diseases or causes not connected with the pregnant state. In twenty-four cases out of one hundred recorded, the severe vomiting was found to have for its origin one of the following abnormities: chronic gastritis, gastro-enteritis, cancer of the pylorus, carcinoma of the liver, biliary calculi, fatty degeneration of the liver, pulmonary and cerebral tuberculosis, polypoid disease of the intestines, etc. These cases of severe vomiting all resulted in death, and the post-mortem examinations revealed the fact that definite lesions existed causing the distressing condition, that was not directly due to the physiological process that was going on.

In the majority of cases in which severe vomiting marks a process that should be purely physiological and without disaster, there are usually present abnormal conditions in or about the uterus. There may be displacements, or induration, thickening, contraction of the cervix, or inflammatory effusions in the vicinity of the uterus. Relief of these abnormities usually stops the vomiting. In other instances induced abortion is the only cure. Even this is at times inefficacious, so profound is the exhaustion induced by the previous chronic starvation. Innumerable drugs have been recommended, most of them quite useless in severe cases. Those likely to be of service are sedatives—cocaine, opium and the bromides. Local medication is of benefit in some instances. Vaginal tampons saturated in poppy decoction are of great use; also cocaine applied to the os or to the interior of the cervical canal, and caustic applications. Hot douches not too frequent.

and rectal suppositories containing opium, morphine, belladonna or hyoscyamus, suggest themselves as valuable aids. The administration of food is of great importance. Sometimes the stomach will retain nourishment given in minute quantities and at frequent intervals. In certain cases starvation can be prevented for a time by the systematic use of suppositories containing nutrient substances. Each case must be dealt with on its merits. Good food, nerve tonics, fresh air and general hygienic measures may give relief when the trouble is not severe. Rest in fair amount Hewitt insists upon, and the horizontal position, maintained in varying degree of strictness, is essential in all cases.—*Medical Record.*

A study of the subject from the above standpoint discloses the fact that none of the ordinary remedies equal the varied resources of electro-therapeutics, in the presence of difficult complications, especially when these are in or about the uterus.

CHAPTER XXIX.

UTERINE FIBROIDS AND TREATMENT OF PATIENTS.

Medical methods. Clinical varieties of fibroid tumours. Surgical methods and indications for each. Indications for galvanic electricity and other currents. Relative place of electrical methods as adjunct to medicine and surgery. The tediousness of any form of treatment. Clinical results in different varieties of cases.

Uterine Fibroids and the Treatment of Patients.—The practical treatment of patients possessed of benign tumors of the uterus depends upon three things: (1) The physician, and his armamentarium; (2) the patient, and her circumstances; (3) the tumor, and its complications.

For complete treatment we now possess the fully ascertained resources of drugs, electric currents and surgical skill. Two or more methods must usually be combined to secure the best results in any case. In no case is a single method complete in itself, and medical, electrical and operative methods have all been brought to a high state of perfection and are ready to be selected from according to the given case.

Each patient is practically a law unto herself, and theoretical indications for operative interference offer the least help to influence the physician's advice. Barriers of a practical nature—the circumstances of the patient, domestic necessities, family affairs and mental convictions—sometimes interpose to prevent either radical or conservative measures for the removal of the tumor. The patient, however, must be given the best treatment that circumstances make available, and to this end let us see what can be done.

The first thing to consider, even before any accurate diagnosis of the exact nature of the tumor need be attempted, is the general health of the patient, for constitutional good health

and a fibroid tumor either do not exist together at the first examination or will soon drift apart, for the tumor flourishes at the expense of nutrition.

Treatment of the nutrition of the average patient is therefore the first step, and to medical remedies to improve nutrition can be added others for special effects. These include a great variety of drugs which may be divided into general tonics, sedatives, anodynes, alteratives, uterine tonics, hemostatics and ergot. When hysterectomy had a dread mortality rate and electrical methods were in an experimental stage of development, almost the whole treatment of fibroids was drug treatment and the useful remedies have been determined by experience.

If the patient can by some means be kept at the point of greatest natural tonicity the tumor will not increase rapidly in size. Prescribe abundant nourishing food, gentle cholagogue laxatives and the bitter tonics, especially cinchona. In all cases of anæmia prescribe iron and the hypophosphites.

Dr. Bedford Brown a few years ago reported 27 cases treated mainly by the free use of the hypophosphites, strychnia and ergot. The cases included all classes from those without marked symptoms to others exceedingly grave, accompanied by alarming hemorrhagic tendencies, peritonitis, septicæmia and general prostration. Most of the cases had remained under observation from five to fifteen years. In all there had been improvement and in one-third positive recovery.

In grave and serious cases he administered as much as a dram of the syrup of hypophosphites of lime and soda every two or three hours, and two drams of the lactophosphates three times daily, until the saturation of the circulation restored the lost equilibrium of nutrition, arrested cell profileration and exudation and promoted absorption.

Along this line of tonic treatment we find extensive directions in text books, including salt baths, changes of climate and sea voyages; but practically all needed supplementary action to the foundation measures stated above may be best

obtained by the use of electricity in some form. Electrical currents are the sheet anchor of conservative measures.

I will speak of local measures later, but for the general treatment of nutrition and the relief of reflex and nervous symptoms we have in the static apparatus the simplest, most practical and most satisfactory means of doing these patients good by electricity.

Static methods of general treatment.—Seat the patient in an easy high-backed chair upon the static platform in the most comfortable position possible. Fibroid patients are nearly always anæmic, nervous or neurasthenic, or subject to aches, pains and reflex disturbances. The expert will at once know how to conform the method to the indications of each case, but the physician who is not practised in the management of the static machine may be guided by the following directions.

At the first sitting connect the platform to the negative pole of the static machine, ground the positive pole and start the machine into moderate action. If two or three moments demonstrates that the patient is not timid and that no alarm is caused by the simple negative electrification stop the machine and change the platform connection to the positive pole, ground the negative pole and again start the machine into moderate action.

At the first sitting simple electrification should be maintained for fifteen or twenty minutes and the patient allowed to become acquainted with the machine and its action so that at the next visit she will feel no nervousness.

The subsequent conduct of each case must depend upon the major symptoms. If the patient is neurasthenic, or hysterical, or rheumatic, or subject to headaches, insomnia, or any of the functional neuroses, we may derive benefits from static electricity which cannot be equalled in any other way, and the methods to employ may be selected by referring to the chapters upon these diseases.

One of the practical points of superiority over administra-

tions with currents which require disrobing and the use of moist electrodes is the facility with which static currents produce their general as well as local effects without any disrobing whatever. The physician who treats pelvic diseases should especially study the electrical treatment of neurasthenia, insomnia, pain and functional derangements, for in these conditions the different electrical currents are indispensable.

The sedative drug remedies usually employed are those which relieve severe menstrual pains, allay nervous irritability and promote sleep. They include opium, all the coal tar anodyne preparations, chloral, hyoscyamus, cannabis indica, the bromides, sulphonal, belladonna, gelsemium, valerian, asafetida, zinc, and a number of others; but, except as temporary expedients, these are quite successfully displaced by static electricity, bipolar faradization and the galvanic current.

For the relief of symptoms the majority of the above drugs have no curative action and are dangerous or injurious when long continued. The resources of medical electricity save the patient from the risk and ill-effects attending the continuous use of drug palliatives.

The employment of so-called *alteratives* includes two remedies of great importance, no matter what other plan of treatment is adopted. These are arsenic and mercury. Five-drop doses of Fowler's solution may be added to the dose of hypophosphites which is taken after each meal.

As a gentle laxative the cholagogue and tonic action of calomel (tablet triturates, 1-20 or 1-10 grain doses—every two, three or four hours daily according to the needs of the patient) is invaluable. Follow the laxative action with a mild saline before breakfast and use the calomel a few days at a time and return to it whenever it is needed. The tongue furnishes a very sure indication for its use. Electricity does not supply the action of this remedy without more troublesome applications than are ordinarily acceptable.

Of the other special remedies the chief are local astringents

applied to the mucous membrane of the uterus and the internal hæmostatics, ergot and hydrastis.

Practically all local astringents and local applications of a medical nature are made obsolete by the immensely superior action of electric currents.

Ergot and hydrastis are the best internal remedies to contract the blood-vessels and modify the hemorrhage. They are given three or four times a day. One grain each of the solid extract in pill form or capsules obviates the disagreeable taste of the fluid extracts. To modify flowing during profuse menstruation the patient should take at least a half dram of each three times a day while the flow is excessive.

The employment of electricity not only supplies the action of these two drugs but goes far beyond them in its effects. At an advanced stage when the growth of a fibroid has practically abrogated the contractility of muscular fibres, ergot ceases to play its great rôle as a hæmostatic.

Ergot and hydrastis may be considered indispensable to the medical treatment of fibroids, but when skilled electrical methods are employed they lose their importance. Electrical currents will not interfere with the physician who deems it wise to prescribe them, but as a rule very few drugs are required to supplement resources of electricity when these are all utilized.

Ergot, however, is most useful in the treatment of submucous fibroids and those which tend to become pedunculated, while electricity hands over to the surgeon most cases of this variety.

The surgical treatment of uterine fibroids involves two classes of operation, one directed to about the same end as electric methods, leaving the fibroid *in situ* and cutting off its nutrition. The other eradicates the tumor, and, if necessary, *everything else*. As operative methods have been brought within recent times to a remarkable stage of perfection almost all that the physician reads in standard text books published more than a couple of years ago is out of date, and some of

the wholesome dread of patients to consider operations for benign tumors is now uncalled for. Surgery, however, *still has a mortality rate*, while electricity has none, and moreover surgery must always be regarded from four separate standpoints which are quite apart from theoretical indications.

In the hands of the very few masters of skill and judgment any patient upon whom they would consent to operate is practically safe so far as danger to life is concerned, but in quite a number of cases the patient fails to secure all the curative benefits desired.

In the hands of less experienced operators whose facilities, judgment and skill are not matured, the percentage of disaster will be much greater, and they should properly consider only the simpler forms of operations.

The third standpoint is that of the general practitioner who does not operate himself but seeks to advise his patient. This chapter is intended to assist him in forming his own judgment.

The fourth standpoint is that of the patient herself, and more often controls the decision than does the skill of the most brilliant operator.

Contrary to the popular belief, however, it is not always in simple cases that any grave question of choice arises between surgery and electricity, but it is quite often in complicated cases, with septic absorption, and when an operation would be suicidal and injure the surgeon's carefully cherished statistics of recoveries, that he voluntarily shifts the responsibility from the knife to another agent. In these desperate cases as well as in hundreds of others electricity has a record of success.

The clinical varieties of fibroid tumors of the uterus are usually separated into three groups, but are divided into *four* groups by Dr. Franklin H. Martin, of Chicago, to whose recent lectures I am indebted in preparing this chapter. The terms employed are:

Interstitial.—A tumor uniformly distributed throughout the body of the uterus. 55 per cent. of all cases.

Intramural.—Fibroid growth from one or more distinct centres of development confined to the wall proper of the uterus. 15 per cent. of all cases.

Subperitoneal.—A fibroid projecting from the walls of the uterus into the peritoneal cavity and tending to become pedunculated. 20 per cent. of all cases.

Submucous.—The same kind of a fibroid projecting from the walls of the uterus into the uterine cavity. It may become pedunculated. 10 per cent. of all cases.

It is in the interstitial and intramural varieties, which make up an estimated 70 per cent. of total cases, that we have chiefly to consider a choice of treatment, for it was in these cases that surgery was most fatal even ten years ago, while electricity was benefiting 95 per cent. of all patients properly treated and destroying none.

The following indications for different methods of treatment are cited from Martin.

Abdominal Hysterectomy.—Successful abdominal hysterectomy is the only *absolutely sure* cure for large fibroids of the uterus. Ergot, electricity, ligation of the blood supply, will cure a certain percentage, but hysterectomy removes at once every vestige of the tumor and with it the uterus on which it propagates.

The operation of abdominal hysterectomy in its present condition of perfection, in the hands of experienced operators, should be the operation of selection for all fibroids which cannot be removed by vaginal hysterectomy when the patient is in a physical condition which will not jeopardize her immediate recovery from the operation.

Multiple intramural fibroids of every kind which are producing distressing symptoms should be submitted to hysterectomy because there is no absolute cure for them by any other means.

Subperitoneal fibroids, when multiple, can only be removed by abdominal hysterectomy, and no other treatment will reach them.

Interstitial fibroids of large size, of hemorrhagic nature, should always be treated by abdominal hysterectomy if the patient is in a fair physical condition.

Cystic fibroids can only be cured by hysterectomy. Any form of treatment less radical only aggravates these cases.

Suppurating fibroids imperatively demand hysterectomy.

Fibroids complicated with pelvic suppurations, pyosalpinx, suppurating ovaries or appendicitis, should be removed at the same time that the pelvis is cleaned out.

Large fibroids complicated with pregnancy where there is the slightest doubt of a successful normal ending of the condition of pregnancy demand abdominal hysterectomy.

In all the above cases only the latest and most improved technique is understood.

Vaginal Hysterectomy.—Vaginal hysterectomy has two divisions, one removing the uterus and its tumor *en masse*, and the other removing them piecemeal—*morcellement*.

The first operation is often the ideal method of treating small multiple fibroids which are so frequently the site of severe uterine pain and excessive hemorrhage. Fibroids of considerable size may be treated by vaginal hysterectomy when the uterus is low in the pelvis and the vagina is large and the tissues loose. The skill of the individual operator controls the scope of this method.

Vaginal hysterectomy by *morcellement* may be done for fibroids of considerable size, but some operators prefer the abdominal method when the uterus is too large to deliver easily after bisecting. The method may be employed: 1. Whenever the mass is largely within the pelvis, especially if it is fixed therein by adhesions. 2. Whenever the mass is soft and therefore compressible. 3. In all other cases where we have a patient in good condition, whose pelvis is shallow; where the vaginal canal is roomy.

Whether suppurating appendages prevent this method of operating depends on the skill of the individual surgeon.

Removal of Uterine Appendages.—But a few years ago this

was the operation of selection for the relief of uterine fibroids, but is now limited to a much smaller number of cases than formerly. It is employed: 1. When for some reason there exists a prejudice against sacrificing the uterus. 2. In cases when for some good reason brevity of time in operating is desirable. 3. In cases where unusual complications, revealed after the abdomen is opened, make hysterectomy impracticable. 4. In cases of small bleeding tumors in weak women who are near the menopause. 5. In cases of small hemorrhagic fibroids in weak women which are complicated with diseases of the appendages but for which laparotomy would not otherwise be ordinarily indicated.

Vaginal Ligation of the Broad Ligament (Martin's Operation).—This operation aims to occlude not only the main channel of the uterine artery but all collateral branches in order to destroy the function of the nerves as well as the arteries of nutrition.

Interstitial fibroids of moderate size are the cases in which the best results will be obtained by this operation. The cases in which the most satisfactory results must be expected are incipient or small fibroids of the interstitial variety which show themselves late in life.

In true interstitial growth depending upon the whole uterus for their nourishment, where in fact *the tumor is the uterus*, and these represent 75 per cent. of all fibroids, this operation may be expected to accomplish prompt and decided relief of symptoms and a rapid reduction of the tumor when it is possible to tie the base of the broad ligament from the vagina.

When we have a uterus which is so small that it has not risen above the brim of the pelvis so that its broad ligaments are accessible from below, the major operation is particularly undesirable, because from the age of the patient the fibroid will soon reach a state of quiescence through the menopause. The ideal cases for the Martin operation are cases of the above character with severe hemorrhage as a principal symptom demanding immediate relief. It may also be employed with

success in cases of continuous and profuse hemorrhage which is depleting the patient so seriously that no radical procedure can be thought of until a minor operation has checked the waste of blood and made recuperation possible.

While this operation has only a limited application in fibroid conditions of the uterus, it possesses some advantages which commend it, viz.:

1. It involves little or no risk when carefully executed.
2. It does not involve a tedious convalescence.
3. It is quickly and easily performed.
4. Its immediate result is to afford prompt relief of the symptoms.
5. Its ultimate result, which is manifest within six months, is complete or almost complete atrophy of the tumor.
6. It does not unsex, mutilate, or disable the patient. (*Goelet.*)

Indications for Electricity.—*Galvanic.*—Without regard to theoretical prognosis or the restrictions of circumstances it may be considered that the galvanic current is practically indicated:

In bleeding fibroids in women approaching the menopause.

In *all* bleeding fibroids of the smooth interstitial variety which have no symptoms but hemorrhage.

In all inoperable cases.

In incipient fibroids in women of any age and especially when near the menopause.

In all cases of the interstitial variety not accompanied with pelvic pus accumulation and cystic ovaries.

In all cases which refuse an operation.

Subperitoneal and submucous fibroids, constituting an estimated 30 per cent. of all cases, are practically outside of direct local curative treatment by galvanic currents. In practice some other cases in which the galvanic current is apparently indicated will fail to derive entirely satisfactory results.

Indications stated in this general way give an imperfect idea of the wide range of practical usefulness contained in the different electrical currents. They will appear more in detail when we consider individual cases.

Induction Coil Currents.—As an adjunct to the electrolytic properties of galvanic currents we have in *vaginal bipolar faradization* a method of great utility for the relief of symptoms and the improvement of nutrition. Reference to the chapter upon the physiological action of rapidly interrupted high-tension currents will point out the uses of this superb aid to the treatment of some patients with uterine fibroid.

Static Electricity.—Next to the direct attack upon the abnormal growth by galvanic and induction coil currents the most important service in the treatment of the patient and her nutrition is rendered by static electricity. It combats the symptoms of general debility, backaches, neurasthenia, insomnia and nervous disturbances, without waiting for the slower action of electrolysis. *Its value cannot be appreciated until its effects are witnessed.* It is a tower of strength to rely upon in the office and in the hospital where pelvic diseases are treated, and in imparting strength to weakened muscles, in improving digestion, promoting sleep and releasing the patient from the bondage of sedatives and hypnotics it acts as a restorative agent of very great practical value.

Comparative Arguments about Operative Methods.—It is argued that "hysterectomy removes at once every vestige of the tumor and is the only absolutely *sure* (?) cure."

"It is argued that a patient suffers less real shock ordinarily when subjected to a vaginal hysterectomy than when operated upon through the abdomen. A vaginal hysterectomy avoids the abdominal scar which so many patients dread as a brand of mutilation which must be carried through life after all abdominal operations.

"Many patients have this wholesome dread to such a degree that there seems to be no comparison in their minds between the two operations. An abdominal operation contains all the horrors of most dreaded surgery, while a vaginal operation with no sign of mutilation left is contemplated like a normal labor with dread but with resignation.

"An abdominal scar it is true will frequently become the site of considerable irritation and in rare cases the site of severely neuralgic pains. There is always, too, the remote

possibility of ventral hernias developing in an abdominal scar.

"However, as soon as we undertake to do a vaginal hysterectomy on anything but the smallest kind of a fibroid we are hampered by the narrow limits in which we have to do our work, and therefore if the tumor is of considerable size it requires an extra time for its proper removal through the vagina, which offsets the advantage gained by non-exposure of the abdominal viscera.

"The rational surgeon must discriminate here as everywhere else in surgery and select the operation which best suits the individual case. If he has a small fibroid, or a large fibroid with relaxed ligaments and a large, roomy vagina, he should select the lower route; whereas, if he has a large fibroid high in the pelvis, or a small one with a narrow contracted vagina and rigid tissues, he should do a laparotomy and remove the tumor from above.

"The operation of removal of the appendages fails about three times in thirteen recoveries to materially reduce the size of the tumor, and fails in one case in thirteen recoveries to produce an artificial menopause, while hysterectomy is absolutely sure of eradicating both the tumor and the hemorrhage in every case that *recovers from the operation*. Removal of the appendages is seldom performed at present except as a last resort when laparotomy for the purpose of hysterectomy has been instituted, but because of contra-indications the major operation is found inadvisable." (*Martin.*)

The present status of the treatment of benign tumors of the uterus by electricity is also well summed up by Martin in the following language:

"As an abdominal surgeon with at least average success, and at the same time as one who interested himself early and enthusiastically in the Apostoli treatment when it made its *début* in this country, I am constrained by a sense of justice, knowing well both sides, to say in the interest of those who have fibroids of the uterus that the knife, even in these times of brilliant successes in surgery, is used too often and electricity too little.

"If a brilliant hysterectomy with its average mortality of five per cent. ended the matter and the 95 per cent. surviving gained *health* immediately we could have but little to say. When, however, we must reckon on *the months of nervous suffering with which the majority of these patients who have their tumors removed have to contend* after this operation *before they receive*

the well-earned cure, and when we take into consideration the not large but certain percentage of fistulas, hernias and other well-known distressing sequelæ following operations, and last, but not least, when we remember the grim spectre of that five or ten per cent. who did not recover, are we not justified, if we have a conscience (especially when we realize that a fibroid of the uterus when left alone seldom proves fatal), in giving our patients the benefit of a treatment which seldom fails to *relieve* these cases, and which, if it frequently fails to cure, *never kills, never does harm, and never interferes with the success of an operation if it in the end fails to cure.*

"Experience in the treatment of fibroids of the uterus by electricity has taught me how to select my cases, when to encourage a patient to receive electricity and when to encourage her to select an operation. In some desperate cases in which submitting to an operation would be clearly suicidal I believe that electricity not only offers a straw of hope to these patients, but a veritable life-boat to their despairing bodies."

The principle of all forms of treatment which do not cut the fibroid out aims to starve it out. This denutritive principle applies alike to drug treatment, electrical treatment and all the operations upon the blood supply and the appendages.

In discussing electricity or surgery *versus* each other (with the patient's view left out) writers may speak from the narrow standpoint of partisanship for the method they prefer, and whether they advocate electricity or give it but faint praise they most often speak of the action of the *galvanic* current *alone*. This does far less than full justice to the practical resources of electric currents, and underestimates by a large percentage the benefits they can confer to both physician and patient in the treatment of fibroid tumors in one of four different ways:

1. To constitute the main treatment in the large number of interstitial fibroids to which electrical methods are adapted and thus accomplish the satisfactory results of at least a symptomatic cure without a surgical operation.
2. To aid the action of other remedies to put the patient in the best possible condition, both mentally and physically, for the ordeal of any necessary operation.
3. To combat the sequelæ of a major operation, relieve the symptoms left over, repair the damages of shock, restore the

nerve forces and put the patient most quickly on her feet. For these purposes *electricity is as valuable after surgery eradicates a tumor and until recovery is complete as it is at any time in the treatment of any other patient.*

4. To come to the rescue in desperate and hopeless cases when as a last resort it can be employed safely when an operation would be fatal. *In cases of this character its achievements take rank with the most brilliant accomplishments in the domain of medicine.*

Other things being equal, the "symptomatic cure" obtained by the aid of electricity without surgery is often better for the patient, and more thoroughly satisfactory than results called by the same name, achieved by operative methods minus electricity.

Those who judge of electricity only by the action of the galvanic current upon the size of the tumor, and do not take into account its nutritional, sedative-tonic, nerve composing, and muscle strengthening properties fall far short of measuring its true value in the treatment of patients.

Before referring to the specific details of treatment there is one point not sufficiently recognized by the profession. It is customary to say that hysterectomy (for instance) removes the tumor "at once" while the "slower method of electrolysis is tedious, exacting and takes a long time."

It is true that the surgeon performs the operation in an hour or less, but let us see about the patient.

For either a vaginal or abdominal hysterectomy she gives up her whole time for hospital preparation for a period which varies with her general health, but let us call it ten days *before* the operation.

After the operation she is a prisoner in bed on a fluid diet for the first week and by no means to be envied so far as comfort is concerned. For the second week after the operation she is kept on semi-solids; and it requires nearly four weeks to fit her system to resume a mixed diet of substantial food. If she sits up at the end of three weeks she is doing well, and if she is able to leave the hospital within thirty or forty days

after the operation she has made a good recovery. This has required, let us say, about fifty days during which the patient has given up every moment of her time to preparing for and recovering from an "instantaneous" cure.

How much of her time will be sacrificed during the succeeding months of nervous suffering which the majority of these patients undergo after an operation need not be estimated exactly, but let us say that a woman with an interstitial fibroid of medium size escapes all the fistulas, hernias, neuralgias and neurotic sufferings which sometimes keep her an invalid for years and scores the brilliant and rare result of a complete recovery from both the fibroid and all its symptoms in two months.

She has in this case spent 1,440 consecutive hours in passing through an ordeal not wholly unattended with danger to life and which has taken from her during that time all power to attend to her social, domestic, family or business occupations. Let us compare the time thus consumed with the time demanded from her by the "slower method" of electrolysis.

The ordinary application of the maximum galvanic current is from three to five minutes, but the application of the electrodes and the increase and reduction of the dose will consume about fifteen minutes.

With the facilities which every operator possesses who treats these cases, the irrigation of the parts and the entire treatment will not average over twenty minutes. Let us add fifty per cent. to this to be devoted to a static or coil administration and call each *séance* half an hour.

After the *séance* the patient who is not sick enough to be confined to her bed by the disease is not confined to her bed by the treatment, and she is free to go home and rest, visit, or pursue the ordinary vocations of her life, with strength which increases steadily.

To equal the demand upon her time required by the surgical operation, which kept her either in bed or a house prisoner for sixty days, she must receive 2,880 electrical treatments aver-

aging one half-hour each. As a matter of fact some cases receive only twenty treatments, some forty, some sixty or more, and while symptomatic relief may possibly begin almost at the first treatment and usually runs far in advance of anatomical reduction in the size of the tumor it is probable that the majority of patients who have been treated by this method by competent operators throughout the world have received not more than an average of fifty *galvanic* treatments.

The direct tax, therefore, of fifty treatments would equal twenty-five hours as against 1,440 hours of absolute sacrifice to the surgical operation.

Eliminating from both methods all complications and considering that the best possible results of an electrical cure are equal to the best possible results of a surgical cure (and they certainly are), the patient has obtained results at less cost of personal suffering and without placing her life in the balance even for a moment of time. In the one case the *surgeon* makes quick work of the operative part of the treatment while the *patient bears the brunt of the battle*, and nurses and assistants do a great deal of work to complete what the knife began.

In the other case the brunt of the operative procedure is borne by the physician. The nurse, the rigorous preparation, the antiseptic dressings and the anxiety are left out of the count altogether and the patient herself is put to the least trouble. Even if a case attended with severe symptoms is advised to rest in bed for several hours daily, she is subject to few of the restrictions attending recovery from a major operation.

Clinical Results.—Apart from the immense aid of static electricity in the constitutional treatment of all the conditions of ill-health associated with pelvic diseases and the important therapeutic actions of induction coil currents in their local reinforcement of intra-uterine galvanic applications the powerful tonic and physiological polar actions (positive and negative),

of the latter produce beneficial effects upon the *patient* with a fibroid tumor which depend upon :

1. The size, character and rapidity of growth of the tumor.
2. Its situation within, or without, the direct path of the current.
3. The symptoms caused by the tumor; severity and chronicity.
4. The complications co-existing.
5. The general health of the patient.
6. The thoroughness of treatment.

Patients who are very little disturbed by symptoms, or whose general health is not yet much impaired, will discover very little benefit which they can appreciate at the time. The value of local electrical treatment in these cases must relate chiefly to prophylaxis. If the effect of a few months' galvanic treatment is simply the arrest of the growth and a slight retrocession of bulk, the value of the treatment will probably appear later on.

Small Fibroids of All Kinds.—Small benign tumors of the uterus are pretty sure to be benefited by intra-uterine galvanic applications irrespective of the situation of the growth. There is a prospect of complete cure when the growth is interstitial and an almost equally good prospect of radical cure in cases which are not quite entirely interstitial.

If all incipient cases were discovered and treated in their early development by the combined resources of medical and electrical methods only a small minority of patients would reach a stage of chronic suffering and menace to life.

Sub-peritoneal Fibroids.—If the health of the patient is impaired to any marked degree the general tonic, nutritional and other physiological actions of the different forms of electric currents will aid in the treatment of the patient, but unless something be done in accordance with some clearly defined indication for local galvanic treatment, it is not worth while to attempt to attack these tumors with electrolysis. Build up the general health, employ the resources

of drugs, and electricity for its general effects, and await the time (which may or may not come) when surgical interference will be necessary. As these cases constitute about 20 per cent. of all fibroids and while refusing an operation may desire to determine the possible benefit of electricity passed directly through the tumor, there is no reason why an effort should not be made, even though out of ten such cases no more than four or five obtain the best results. It is the situation, and not always the character of these tumors which makes them difficult to treat by non-surgical methods.

Sub-mucous Fibroids.—When these are easily enucleated there is no place for local electrolysis in their treatment. If they produce symptoms which threaten the health they are a case for the surgeon, but both to improve the general health before the operation and most quickly restore the mental and physical condition of the patient after the operation, we have invaluable remedies in bipolar faradization and static electricity. The percutaneous or intra-uterine application of the galvanic current may be helpful to reduce a hemorrhagic tendency, but the general symptoms will be greatly relieved by the other currents.

Fibroids of Rapid Development, Fibroids of Cystic Nature, Suppurating Fibroids, Multiple Intramural Fibroids.—The resources of both static and galvanic currents, together with vaginal bipolar faradization (whenever it is indicated), will assist medication and nutrition in repairing the general health *before* an operation and will render immense assistance *during the period of convalescence.*

Inoperable and Complicated Fibroids.—In considering the clinical results which may sometimes be procured in cases that the surgeon declines, Martin states as follows:

> The cases which are referred to the writer are for the most part complicated cases which the ordinary surgeon shuns. One complication which frequently induces the surgeon to shift the responsibility of these cases is that of severe purulent metritis and endometritis, accompanied frequently with discharges of

gangrenous masses from sub-mucous fibroids, all accompanied with much pain, more or less hemorrhage, and with the discharges inclined to be very offensive. The patients are usually poorly nourished, with white and waxy skin, in consequence of septic absorptions.

When they reach this stage they are frequently pronounced malignant. The outlook for an operation is certainly not flattering. Usually in these cases we have to deal with a tumor of large size, extending to the umbillicus. It is soft, with nodular masses projecting from its peritoneal surfaces. The cervix is soft and patulous, with a canal large and irregular. Sometimes a small nodular mass is presented at the cervix. This is usually soft and easily broken down. The endometrium and all cavities from which masses have been projected or from which they have sloughed away are infected and ulcerated, emitting a discharge which rapidly becomes offensive. From the large mucous membrane occur periodic and irregular uterine discharges which serve to swell the already copious outpour.

The writer has treated by electricity and symptomatically cured several of these cases in which the diagnosis of cancer had been made by conscientious surgeons of more than ordinary talent.

These cases respond rapidly. The powerful antiseptic action (of metallic electrolysis) on the mucous membrane makes itself apparent by the decreased odor of the discharge. The passing and withdrawing of the electrode opens and provides free drainage for the secretions. The discharge of blood is lessened. The patient is toned mentally and physically by the general effect of electricity on her system. In a word, it is frequently marvellous what a transformation will take place in these apparently hopeless cases in a few weeks of judicious galvanic treatment.

While these cases are apparently hopeless from the standpoint of the surgeon, they are frequently symptomatically cured by this simple remedy. The writer has a long list of such cases, and they constitute some of the most satisfactory work he has ever had placed to his credit.

There is a class of complicated cases of different kinds in which it is impossible, because of the contortions of the growth, to enter the uterine canal with an electrode. Only in the most desperate cases, in which submitting to an operation is clearly suicidal, would one think of employing electricity as a means of treatment when an intra-uterine electrode was impossible. But it is in just these cases, with their distressing neuralgic and pressure symptoms, with dyspeptic complainings and in-

testinal irritations, the result of reflex nerve disturbances, in which an operation is discouraged, that we find patients ready to catch at any straw.

In many of these cases I believe that electricity not only offers a straw but a veritable life-boat to their despairing bodies.

All that we can expect to accomplish is that beneficial action derived from passing a strong galvanic current through any tissue containing muscles, nerves, lymphatics and blood-vessels, viz., a powerful trophic stimulation to the part and incidentally a powerful general tonic effect on the general system.

These cases get great relief. Neuralgias stop. Troublesome abdominal reflexes cease. Circulation is improved. Nutrition is stimulated. Sleeplessness disappears. Bowels are stimulated and relieved of troublesome distension symptoms. The tumors often seem to decrease in size.

The degree to which each of these symptoms is relieved varies of course in individual cases. The writer has seen a large number of cases completely, and for an indefinite time, relieved of all these symptoms. In fact, some of the most gratifying cases of relief he has had are of this variety. These cases are apparently so hopeless that often any relief is very gratifying.

Typical Bleeding Fibroids of Interstitial Variety.—This is the class of cases making up a very large percentage of all fibroids in which electricity finds its best field of employment and may be considered adequate to relieve the patient from the dread of an operation, except in rare cases. Sometimes a complete anatomical reduction of the tumor is effected as completely as if it had been cut out, but only an arrest of development with a partial shrinkage in size is expected to result from ordinary treatment.

When patients are relieved of their complaints, they seldom continue treatment for theoretical advantages, and if the tumor no longer gives them any trouble they are usually happy.

Static electricity, for its general constitutional effects, and vaginal bipolar faradization, are practically an indispensable auxiliary part of the treatment of fibroids by galvanic currents. No single remedy or single type of current suffices.

In these cases the clinical results are either a great amelioration of all the symptoms with perhaps some lingering com-

plaint in one or two of the most obstinate disturbances, or a complete "symptomatic cure," which may at some future time break down under impaired general health and require a fresh period of treatment to establish it again.

These cases begin to improve almost immediately. The first improvement is the relief of the two cardinal symptoms, hemorrhage and pain. Grand and Famarque state that having followed attentively all the patients in Apostoli's clinic for more than four years they have seen no case of the above character in which hemorrhage was not arrested, and only in rebellious hemorrhages of malignant neoplasms have they seen the combined resources of electricity fail. All the functional disorders, dysmenorrhœa, amenorrhœa, leucorrhœa, vesical irritability, constipation, neuralgic pains, muscular achings, cardiac and other neuroses, etc., disappear entirely or greatly improve.

For the control of pain electricity is much more certain than surgery, and two of the greatest triumphs of electrical treatment as now employed are the control of hemorrhage and the relief of pain. The efficient treatment of the endometritis which almost invariably is found in fibroid cases is a third triumph of galvanic currents.

Of the results obtained in these typical cases by electrical treatment in his own experience during the past ten or more years Martin states:

The first improvement, following almost the first *séance*, is the relief of neuralgic and so-called pressure pain. In a few days they find that their general strength is improved. Reflex disturbances, such as stomach irritation, palpitation of the heart, occipital headache and backache will be relieved. The patient will begin to eat and sleep naturally. There is a general feeling of well-being engendered.

In a few days the leucorrhœa or purulent discharge from the endometrium will diminish. As the patient arrives near the menstrual period she finds that the old pre-menstrual aches are not present and the old despondency is absent. If the treatment has been sufficiently active the menstrual flow will arrive without pain in many cases. Occasionally, the first month the flowing is fully as free as usual, although

frequently it is much reduced. If the treatment is continued for two or three months these patients will begin to maintain that they feel perfectly well.

All the old distressing symptoms will very often disappear entirely. They will gain flesh and the uterine discharge will become normal.

While the tumor will still be apparent to the physician's examination it will almost invariably be found much diminished in size. When the time arrives that these patients are symptomatically cured, that is when they feel no symptoms, I usually discharge them. As long as they are free from symptoms they may be satisfied that the tumor is not growing—on the contrary is decreasing in size.

Fibroids with Peri-uterine Inflammatory Complications.—If these complications are not suppurating, or of a character which either threaten life or prevent successful electrical applications, but are simple acute, subacute or chronic inflammations of any of the pelvic tissues, the final results of preparatory *bipolar faradic sedation* and later treatment by modified *galvanic* currents will probably be satisfactory to the patient and obviate any need for an operation, but the progress of the case will necessarily be very much slower than cases which are not thus complicated.

During the past ten years so many reports of clinical cases with large percentages of good results have been published that it is no longer necessary to present evidence of the fact that electricity is the chief of conservative therapeutic measures and that the clinical results in carefully selected cases are as good, from the operator's standpoint, as the best results of hysterectomy, *while from the patient's standpoint they are much better, for she still possesses her tubes, ovaries and uterus,* and anticipates none of the uncertainties of an artificial menopause produced perhaps five, ten or more years before the time set by nature.

Electricity, when it relieves, does not mutilate, leaves no stump or adhesions to be the site of obscure pains, and while it is performing its gradual work upon the fibroid it is also establishing general benefit to the patient's health, comfort and mental condition, which is of inestimable value.

CHAPTER XXX.

ELECTRICAL TREATMENT OF DIFFERENT VARIETIES OF FIBROIDS.

Treatment of fibroids without serious symptoms or complications. Treatment of fibroids with various degrees of hemorrhage. Treatment of fibroid patient with suspected complication which may contra-indicate electricity. Treatment of intra-mural fibroid, single or multiple, situated in close proximity to the mucous membrane. Intra-uterine pedunculated fibroids. Sub-mucous fibroids of considerable size. Small uncomplicated fibroids of all varieties except pedunculated polypi. Interstitial fibroid of moderate size with desperate and profuse hemorrhage. Fibroid complicated with pyosalpinx, ovarian cyst, or ovarian abscess. Cystic fibroids. Suppurating fibroids. Large fibroids complicated with pregnancy. Sub-peritoneal fibroids.

ANY synopsis of a large subject offers less direct help to the formation of judgment to meet the needs of an individual case than does the consideration of separate cases in detail. I shall now outline suggestions for treatment in the manner which I believe to be most instructive to the practitioner who is not a specialist. The directions given will not be influenced by a one-sided advocacy of electricity but will be such as commend themselves to the author's judgment as best for the welfare of the patient.

Treatment of a Fibroid Patient without Serious Symptoms or Complications Before a Complete Diagnois is Determined. —Investigate first the general health of the patient in every case, and prescribe diet, hygiene and medication directed to putting her in the best possible state of nutritional tonicity.

While the first pelvic examination may satisfy the physician that he has to deal with a fibroid tumor of a more or less definitely ascertained character, yet there are a number of things

that touch alone does not discover even when aided by the eye and ear. A complete understanding of each case may be considered a somewhat gradual development, and therefore the treatment of the fibroid does not really begin at the first sitting.

After the bi-manual examination and other methods which may be employed the first preparatory step is *bipolar faradization.*

To avoid repeating in detail the full technique of all variations of this method the reader is referred to the section describing it in full. (See INDEX.)

Leave the patient in the dorsal position upon the operating table exactly as she was placed for the bi-manual examination, and at once, after ending the examination, connect the tip of

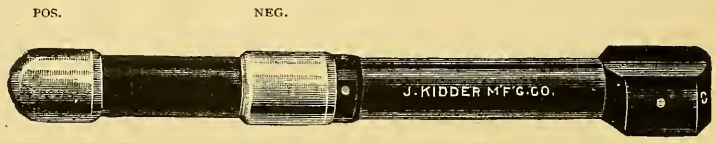


Fig. 205. Bipolar vaginal electrode.

the vaginal bipolar electrode with the positive pole of the high-tension induction coil apparatus and the remaining half to the negative pole. Warm and lubricate the electrode with a little plain vaseline and insert it as deeply as it will go into the cul-de-sac of the vagina.

Retain it carefully in position during the *séance* so that it cannot possibly slip out. Switch the 1,500 yard No. 36 coil, four cells and the rapid vibrator into circuit and regulate the current strength from zero up to the point of strongly marked sensation.

If this requires a dosage of mild sedative action, and pain is felt when the current is somewhat increased, repeat the sedative applications daily and observe the effect. If congestion, tenderness and pain are of a simple nature they will rapidly disappear under the efficient influence of bipolar faradic sedation, which will not only compose the nervous system, fortify

the patient against timid fears of being hurt, win her confidence and gratitude for the great benefit this preparatory treatment produces, but will add another point to the diagnosis. It at once determines between pain due to an inflammation of the appendages and all other pains of a functional, congestive, nervous or hysterical nature.

If the tissues are not sensitive and at the first sitting the current from the 1,500 yard coil with the full E.M.F. of four or five cells is scarcely felt and a toleration is demonstrated to strong currents from any of the shorter coils of No. 36, No. 32, or coarser coils, it is almost certain that inflammatory complications do not exist, and this is an important fact to determine before commencing intra-uterine galvanic treatment.

At the second or third sitting (if the patient is not irritable or timid so as to require further bipolar sedation) place her in exactly the same position and make a test application of an intra-uterine positive galvanic current.

Thoroughly moisten in the soda bicarbonate hot-water solution a felt-covered, flat electrode, 7×10, and place it upon the

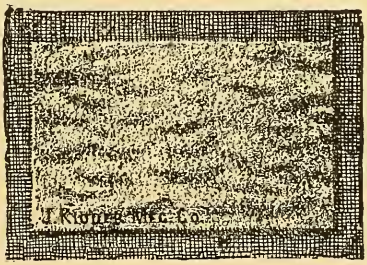


Fig. 206. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

lower abdomen or beneath the sacrum, whichever is most convenient. Connect this electrode with the negative pole of the galvanic battery. Place it in position *first* so that it will be saturating the tissues and reducing the resistance of the skin. Next irrigate the vagina thoroughly with the antiseptic solu-

Fig. 207. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

tion which the operator is accustomed to employ. Sterilize next the platinum intra-uterine electrode-sound in the usual alcohol flame and connect it with the positive pole of the galvanic battery and insert it to the fundus of the uterus. In all simple cases when a speculum will easily engage the cervix I prefer to use it during the galvanic application, but in all other cases it is best omitted, and it is not a necessity. When the operator's hand guides the electrode it should be surgically clean.

Support the electrode in natural position without pressure and increase the constant galvanic current through the rheostat very gradually up to about thirty mil. In many cases fibroids are less sensitive than the uterine tissues usually, but the object of this application is not yet to treat the fibroid but to test the tolerance as one of the final important steps in the diagnosis.

Request the patient to speak when the current hurts her and again cautiously increase the dose still further until she is comfortably conscious of the intra-uterine current. If this dosage (now held stationary) becomes even more comfortable and less perceptible each moment, if the meter registers between 40 and 60 mil., and if after about five minutes the current is reduced to zero and the patient then expresses a sense of well-being, the fibroid is probably without complications.

After withdrawing the electrodes repeat the antiseptic vaginal irrigation and insert a loose tampon of antiseptic gauze around the cervix, to be removed by the patient the next morning. Have her return the next day to report.

In the intra-uterine treatment of any condition which em-

ploys above 50 mil. of the positive galvanic current contractions of the uterus will be set up. These will cause moderate contraction pains after the application which the patient will define as colic. So long as colic only is complained of, and especially if this passes away upon resting in a recumbent position for a short time after treatment, the indications are good. But if other post-operative pains, distress or a febrile reaction occurs there is reason to suspect some peri-uterine inflammatory state which will require either a reduction of the dose temporarily, or another form of application must be substituted until this lesion abates.

If there is chilliness or chills, faintness and other symptoms, developing an hour or so after treatment, the presence of pus in the tubes may be suspected. If a salpingitis exists which is not yet quite advanced to suppuration it will cause similar but less severe symptoms. If the fibroid is complicated with some uterine or peri-uterine inflammation, the degree of the inflammation, and whether it is suppurating, or of a simple chronic character, is revealed *by the intensity of the febrile symptoms which follow the galvanic application of sufficient strength to aggravate.*

If, however, the patient returns and says that she either "felt nothing" or only a little "colic" or "pain in the back," which quickly passed away, and that she not only feels no worse but thinks she felt brighter and possibly slept a little better, it can be affirmed that the fibroid is without complications and a systematic plan of treatment can now be carried out. The best future treatment which can be given this patient will embody the following:

1. Measures to sustain and promote nutrition.

2. Static administrations to reinforce the above, aid sleep, combat neurasthenia, strengthen the nerve forces and relieve reflex, nervous and other symptoms not those of mechanical pressure. (For headaches, backaches and nervous irritability, the assistance of the static machine is indispensable.)

3. The regular administration between menstrual periods of

intra-uterine galvanic applications with the dose steadily raised to the *efficacious intensity*, which depends upon the varying condition of the tissues and must always be regulated by skilled judgment. The novice cannot regulate the dose by rule.

4. Bipolar faradization for five or ten minutes following each galvanic application.

With mild dosage and ordinary increase of tolerance the intra-uterine applications are repeated three times a week. They may be repeated every second day if the progress is especially favorable, or, if a skilled operator employs the highest intensities that are safe, the sittings should be less frequent, or about once in four days.

In proportion as the treatment is well supported by the tissues and temporary irritations do not arise, the treatment may be increased both in frequency and dosage and thus accomplish results more rapidly.

Treat the patient so long as she improves, and when the growth is not only arrested but has receded to a standstill and the symptomatic disturbances are well relieved, advise her in regard to maintaining her general nutrition at the highest point and instruct her to return in the future for renewed local treatment when she experiences any important change in her condition.

This plan of treatment will maintain a state of "symptomatic cure," relieve the mind of the patient from any cause for anxiety, and owing to the benign nature of the tumor practically puts out of the question the consideration of operative procedures.

Treatment of a Fibroid Patient with Various Degrees of Hemmorrhage before a Complete Diagnosis is Made.—When this symptom brings the patient to the physician, and immediate danger to life is not threatened, prescribe indicated drugs, and while waiting to decide upon the best ultimate plan of treatment administer *vaginal bipolar faradization* at the first sitting if the loss of blood is limited to simply profuse menstruation and the patient is not unwell at the time.

If she is unwell, or suffers from a passive continuous oozing, omit the bipolar and make the application with the *galvanic* current. Place two similar felt-covered, flat electrodes, 7 × 10,

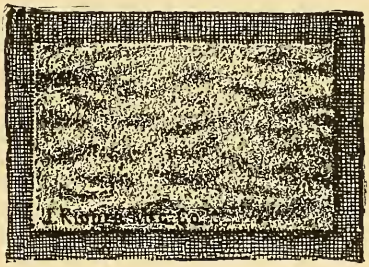


Fig. 208. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

well saturated in the invariable hot-water solution of soda-bicarbonate, upon the sacrum and lower abdomen externally. Connect the abdominal electrode with the positive pole and the other with the negative.

Gradually increase the constant galvanic current from zero to the maximum tolerance of the skin, and if any abrasion of the surface causes discomfort and prevents increasing the dosage to above 50 mil., reduce the current to zero, lift the electrode, and cover the spot with any protecting non-conductor, and again raise the current to the maximum of comfortable tolerance.

During the sitting be guided by the patient's comfort and either reduce the amperage a little if she complains, or increase it if greater tolerance gradually develops.

After fifteen or twenty minutes reduce the current gradually to zero, remove the electrode, dust the skin with toilet powder and close the sitting.

Applications of this kind may be repeated daily, or at least every second day, for a short time, and in uncomplicated cases it is not only excellent preparatory treatment for the general welfare of the patient, but quite often will reduce materially

the loss of blood. If the hemorrhage is more active and this application fails it remains to choose between one of the other more active electrical methods and a surgical operation.

If it is known that the tumor is not complicated with either of the three conditions which practically contra-indicate electricity, there is no question about the sound judgment of employing it *first*, for it may not only accomplish the desired end, but do it speedily without the ordeal and the convalescent period required by almost any form of surgical operation.

The methods of next employing electricity are:

Vaginal application.—A positive carbon ball electrode protected with either clay or a mass of absorbent cotton is inserted

Fig. 209. Carbon ball electrode.

in the vagina if entrance to the uterine cavity is not desirable or possible. A negative felt-covered, flat electrode of large size is placed upon the lower abdomen. The constant galvanic current is increased from zero to the point of maximum tolerance.

The management of this method, which is described in its full details so often in these pages, will be directed by the

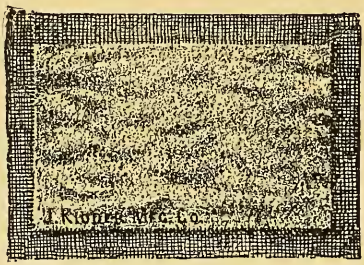


Fig. 210. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

judgment of the physician according to the nature of the individual case.

Intra-uterine positive applications.—These are by far the most effective and are indicated whenever an electrode can be got into the canal, if inflammatory or suppurative lesions do not prevent the safe use of a proper dose. The external electrode should be a pad placed both upon the abdomen and lower spine and connected by a bifurcated cord with the negative pole of the galvanic battery.

The positive pole may be the usual platinum sound if it can

Fig. 211. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

be brought into contact with the entire canal, or, if the operator has assorted zinc sounds, he may select the largest that will fit the canal and amalgamate it with mercury.

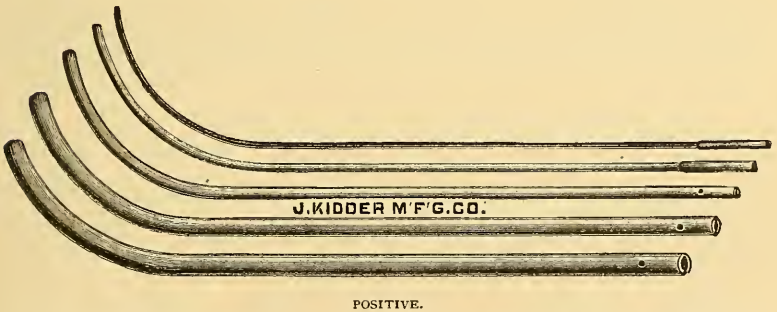


Fig. 212. Five electrodes: insulated with soft rubber tubing to expose any desired surface.

If the rigid sound will not enter or conform to a tortuous canal the surface may be treated in sections by selecting one of the tips employed in metallic electrolysis, either copper, zinc or zinc amalgam, and employing it upon a more flexible handle marked in sections each the length of the tip.

The internal electrode is connected with the positive pole

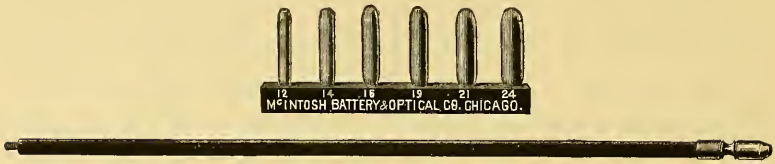


Fig. 213.

and the principle of the treatment is the same in all. The management of the dose and repeating the application is the same as in the treatment of metrorrhagia already familiar to the reader.

Within one or two weeks in most cases, or probably within a month, a decisive result will be secured, and the effects obtained will decide the physician in choosing to continue medical and electrical methods for the permanent treatment or advising other operative measures.

While the tonic, nutritional, vaso-constrictor and hemostatic properties of the positive galvanic current are remarkably efficient in abating hemorrhage and may be supplemented by the muscle-contracting induction coil current, and also assisted by hydrastis, ergot and other drugs, yet the electrical application may fail for one of the following reasons:

1. The surface of the galvanic electrode may not come everywhere in contact with the mucous surface and any part which is not directly acted upon may continue to bleed.

2. The operator may fail to employ a sufficiently active current.

3. The fibroid may be of a variety which the current affects least and be so situated that the current does not pass through its substance, or act upon it most favorably.

4. The tumor may prove to be undergoing malignant degeneration.

Even in cases in which consultants may advise an operation these methods should first be tested in the interest of the patient, for if they are effective she is the gainer, and they are effective in a very large majority of cases.

In a small number of average cases they may fail for various reasons, but in that event the patient is also the gainer, for she then consents to the operation with her mind supported by the knowledge that she has left no conservative means untried. She is also the gainer from the fact that the effect of proper electrical treatment generally puts her in a better condition for an operation than she would otherwise be.

Treatment of a Fibroid Patient with Suspected Complications which may Contra-indicate Electricity.—If the patient is not in immediate danger to life the obvious course is to begin with nutrition, medication and the tonic resources of electricity to benefit her general health, and then find out what the exact pelvic condition is. This may take a little time, and ordinary methods of examination for diagnosis should be supplemented by ascertaining the reaction of the tissues to tentative galvanic applications.

First test the effect of vaginal bipolar faradization for one or

Fig. 214. Bipolar electrode.

two sittings, or more, if the case requires continued sedation before attempting anything else.

Next test the effect of the galvanic application with the negative electrode upon the abdomen, or under the sacrum, and the positive carbon ball electrode covered with a protecting mass of absorbent cotton inserted into the vagina against the appendages. If tolerance to this application is demonstrated, next make an intra-uterine positive application, and

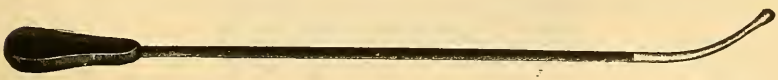


Fig. 215. Intra-uterine electrode, platinum stem, two and a half inches long. Size, No. 11, French.

await the post-operative effects. Refer to the section describing these diagnostic reactions in full, and be governed accordingly.

If patient examinations and these electrical tests indicate that there does not exist and cannot be produced a sufficient tolerance in the tissues to permit employment of effective denutritive doses of the galvanic current, it is useless to attempt local curative treatment with electricity. It does not much matter whether the diagnosis can determine that the patient has suppurating or cystic tubes or ovaries, or whether the fibroid is fibro-cystic, or is really a cancer, for the intolerance of the tissues decides against the use of electricity on the one general principle that it cannot be employed with benefit.

As soon as this is demonstrated there is no further conservative argument between the patient and the selected form of surgical operation which the lesion may require.

After the operation and during convalescence the patient may derive great practical benefit in more quickly recovering her health and being relieved of symptomatic disturbances by the aid of indicated applications of galvanic, or faradic, and especially of static electricity.

Treatment of Intramural Fibroid Single or Multiple, situated in Close Proximity to the Mucous Membrane.—In a case of this kind in which the uterus is found to be considerably enlarged, the canal long and tortuous, with hemorrhage a marked symptom, the preliminary treatment of the patient

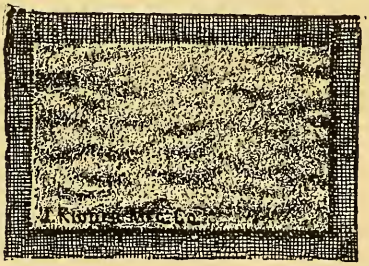


Fig. 216. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

may be begun with ergot and hydrastis in large doses, nutritional and tonic remedies, and percutaneous applications of the galvanic current with a large felt-covered, flat electrode (negative) under the sacrum, and a similar positive electrode on the abdomen.

As soon as the tumor begins to protrude beneath the mucous membrane, its enucleation may be materially assisted by incising its capsule, and it may possibly be expelled by uterine contractions, or should be removed by the surgeon. These are not cases to treat continuously by any tedious method, because they are so easily removed. If tentative intra-uterine galvanic applications give no relief after a reasonable time it is useless to persist.

Intra-uterine Pedunculated Fibroids.—As these are removable by twisting them from their pedicle with a pair of forceps if the pedicle is thin, or severing them with scissors or the knife by the simplest type of operation, it is useless to consider other methods of radical cure.

A number of symptoms, however, may be relieved by the employment of electricity while the patient is waiting for circumstances to make the operation convenient, and such symptoms also as may linger after the polypus is removed may be corrected in the same manner, and general health more rapidly restored than without the aid of electricity.

For general constitutional treatment the static apparatus is useful in all neurasthenic states.

Sub-mucous Fibroids of Considerable Size.—When tumors of this kind have their principal bulk buried in the walls of the uterus it is difficult to enucleate them and the operation of choice is a hysterectomy. But while this may be the surgeon's opinion both the patient and the conservative practitioner may think there is no hurry about it and it probably may not be necessary at all while the tumor remains benign and does not threaten life.

Electricity will not produce a "radical cure," but the prognosis is very good that by the aid of nutrition, medication and

electrical methods the patient may be "symptomatically cured" for a long period of time, and as a matter of fact kept free from suffering or alarm on account of the tumor as long as she lives. The treatment therefore may be palliative and satisfactory without a radical operation. If however the lapse of time brings it about that one or two cases out of a dozen such patients finally either require or wish a hysterectomy they go to the operation uninjured by former conservative measures, and after the operation may again be assisted to improved health and symptomatic relief by selected forms of static, galvanic and induction coil administrations.

Small Uncomplicated Fibroids of all Varieties except Pedunculated Polypi.—As small fibroids are almost always in some degree benefited by electrical methods and as they may be discovered as many as ten or even fifteen years before the menopause, it is eminently wise to exhaust all reasonable conservative measures before demanding that the patient shall submit to any of the more formidable operations for these benign tumors.

Except in an occasional and rare case which demands an operation for special reasons it is good practice to begin the treatment of the patient with nutritional, medical and electrical treatment for the general health, and direct local measures towards a symptomatic cure with an arrest of the growth and a possible reduction in its size.

The maintenance of good general health will alone tend to prevent the growth of the tumor, and the prognosis under the combined methods of vaginal bipolar faradization and intra-uterine galvanic applications is so generally good as to satisfy the needs of this class of patients. The choice between good results if they can be obtained in this way and the average results of hysterectomy or removal of the appendages is decidedly in favor of the conservative plan.

Interstitial Fibroid of Moderate Size with Desperate and Profuse Hemorrhage: Radical Operation Unsafe.—In a case of this kind in which continuous and neglected hemor-

rhage has depleted the patient beyond power to rally from a major operation there is a choice of methods.

If the patient is practically exsanguinated and there is no time to waste, the method to pursue may be decided partly by the wishes of the patient and the resources of the attendant physician.

These are the typical cases in which a well-supported positive galvanic current of high intensity thoroughly applied to the mucous membrane of the uterus has over and over again, in hundreds of reported cases, demonstrated its power to meet the emergency and save life. As an alternative procedure the Martin operation of vaginal ligation of the broad ligaments with the nerves and blood-vessels contained is favorably considered by the author of it.

Whichever of these two methods can be best employed *practically* (without regard to theory) should be used.

If the physician is an experienced electro-therapeutist he can pretty thoroughly test the galvanic application almost before the patient and surgeon could get ready for the operation, and without interfering with either. If the hemorrhage was even partially controlled by the first application it would afford encouragement to postpone the operation and leave the case in the hands of electro-therapeutics. If the hemorrhage was of a rebellious nature which baffled the action of the current the operation should proceed without delay, but the patient should be given the benefit of a percutaneous application of a powerful galvanic current for its general tonic effect upon her system and its sustaining action to the heart, mental state and nerve forces. Every patient who is subjected to an operation involving shock would probably derive assistance from this application if it could be repeated two or three times before the operation as a routine part of preparatory treatment.

Fibroid Complicated with Pyosalpinx, Ovarian Cyst, or Ovarian Abscess.—When these complications are known to exist they at once remove the patient from the curative action of the galvanic current, and the patient should be

advised that her best interests will be consulted by some form of operation. A choice of method must be governed by the surgeon's judgment, but the function of electricity in these cases (which fortunately are in the minority) lies in assisting to aid nutritional and tonic remedies for the general health before the operation, relieving symptoms during convalescence and promoting the best possible recovery.

It is sometimes the case that minor operations without complete hysterectomy may be supplemented by successful conservative measures afterwards if the patient refuses consent to the removal of the uterus.

Cystic Fibroids.—These are not amenable to curative treatment by electrical methods. They can only be "radically cured" by hysterectomy and the patient should be advised of this fact.

After the operation however the tonic, nutritional, restorative and pain-relieving properties of the various currents may be advantageously employed to shorten the period of convalescence and bring about the best results.

Suppurating Fibroids.—It is almost unnecessary to consider this rare occurrence, but there is no doubt about the imperative demand for hysterectomy in any such case. If the patient lives she will need all the help of both galvanic and static currents to restore her general health.

Large Fibroids Complicated with Pregnancy.—If there is doubt of a successful normal ending of the condition of pregnancy abdominal hysterectomy is indicated in the interest of the patient.

If no immediate operative interference seems called for let the patient alone until after delivery and then employ every possible means to promote successful involution. To accomplish this result the most valuable assistance is obtained from the daily use of induction coil currents. (See INVOLUTION.)

The subsequent course of treatment can be determined upon according to the results. As soon as the patient is up

and able to attend for office treatment she will derive great benefit from static administration.

Sub-peritoneal Fibroids.— If the patient desires a radical cure there is no certain method of treatment which will reach these cases equal to abdominal hysterectomy. Palliative treatment by medical, nutritional and electrical methods is perfectly practicable and in a great many cases produces satisfactory results although these tumors are out of direct reach of the current and relief is necessarily slow.

A few operators substitute special methods of their own device in getting electrical currents into efficient relation with these masses, but as such operators are already expert and need no instruction, and the average practitioner could not apply such methods safely, I omit them from this chapter.

CHAPTER XXXI.

ELECTRICAL TREATMENT OF FIBROIDS (*Continued*).

Inoperable fibroid complicated with severe purulent metritis and endometritis. Inoperable fibroid with inaccessible uterine canal. Typical varieties for electrical treatment. Interstitial non-bleeding fibroid. Interstitial bleeding variety. Electrical methods for the control of hemorrhage. Clinical remarks as to choice of method. External method of treating fibroids. Vaginal and abdominal puncture.

Inoperable Fibroids Complicated with Severe Purulent Metritis and Endometritis.—In a case of this kind we have generally a tumor of large, non-indurated, nodular masses, with soft patulous cervix and large irregular canal. Owing to sloughing masses, ulcerations and copious and offensive discharges malignancy may be suspected, and the patient may either refuse an operation or a surgeon may decline.

Immediately begin the treatment of such a case by every possible tonic and nutritional resource, and if the patient is in a hospital, a sanitarium or physician's residence, in which a static apparatus is available, do not forget the great nutritional and strengthening sedative-tonic properties of static electricity.

Begin local treatment by removing with a dull curette all the superficial *débris* from the uterine cavity. Then ascertain the depth and shape of the canal with a soft flexible sound, and shape accordingly the largest zinc intra-uterine electrode that can be inserted to the fundus.

Under the sacrum and upon the lower abdomen apply felt-covered, flat electrodes, 7×10, well moistened in the usual hot-water solution of bicarbonate of soda, and connect them with a bifurcated cord to the negative pole of the galvanic battery.

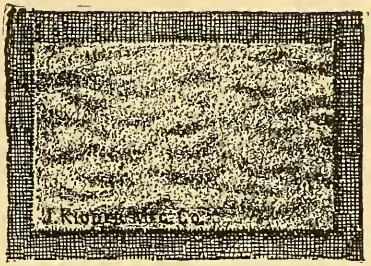


Fig. 217. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

While they are saturating the tissues amalgamate the zinc electrode with mercury and insert it into the uterus so that the amalgamated portion is in contact with the entire lining from the external Os to the fundus. The remaining portion is always protected by an insulated sheath to avoid contact with the vaginal tissues.

The routine antiseptic precautions which precede these steps are of course understood, but the action of the current which is about to be made is in itself absolutely aseptic and germicidal.

Connect the zinc electrode with the positive pole and gradually increase the constant galvanic current through the rheostat from zero until about 40 mil. is reached. Owing to the large surface area of the electrode this is much less than the tolerance of the tissues should support, but the first sitting should always be conservative. If the current is comfortably borne continue the application about ten minutes and reduce the current to zero. The electrode does not adhere to the tissues and possesses this great advantage over cupric electrolysis. After withdrawing the electrode again irrigate the cavity with an antiseptic solution and insert iodiform gauze around the cervix. Prescribe antiseptic douches night and morning and keep the patient in bed.

If no disturbing symptoms follow the first application it

may be repeated the next day with as much increase in dose as the comfortable tolerance permits.

If after two applications tolerance continues to increase the dosage should be increased and at each sitting raised to the limit of intra-uterine comfort. The maximum dose should now be limited to five minutes and the applications repeated only every second day. As soon as convalescence is established and the worst symptoms are controlled the combined use of bipolar faradization and the intra-uterine zinc amalgam electrolysis may be modified according to the indications. After the need for frequent local applications is passed they may be made only twice a week and later only once a week with the galvanic current, and the bipolar method may be employed about three times a week for its tonic and nutritional effects.

If the case is successfully conducted by these methods to restored comfort she may afterwards return from time to time for temporary treatment whenever her general health relapses.

Inoperable Fibroid with Inaccessible Uterine Canal.—Cases of advanced and complicated tumors which have deformed the uterine canal and displaced the cervix so that it is impossible to insert an intra-uterine electrode should be subjected to operation if life is threatened and the patient does not refuse. There are, however, two indications for an attempt to help these cases with electricity, even though the lack of an efficient method of employing it reduces its use to either a "last resort" before calling a surgeon or a "straw of hope" after (in a desperate case) the surgeon declines.

The first application after prescribing whatever medical measures are indicated should always be *percutaneous galvanism*, for the reason that it will have a tonic effect upon the patient and allay her nervous fears without in the least taxing her strength or hurting her.

Saturate two felt-covered, flat electrodes, 7×10, in the usual hot solution of bicarbonate of soda and place one over the tumor in front and one under the sacrum. Connect the posi-

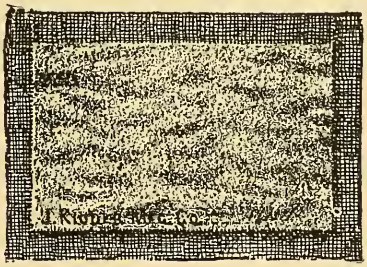


Fig. 218. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

tive pole to the one which is in nearest relation to the greatest tenderness or pain. Increase the constant galvanic current from zero up to 20, 40 or even 60 mil., according to the tolerance of the tissues, but increase it very gradually and stop the moment the patient feels the slightest discomfort.

After securing a proper regulation of the dose continue the application for 20 or 30 minutes if it produces a constantly increasing sense of comfort to the patient. If, however, any fatigue or discomfort ensues at any time reduce the current to zero, remove the electrodes, dry the skin, dust with toilet powder and repeat the application the next day.

The next and more active step of local electrolytic treatment is the *vaginal* application of positive or negative galvanic currents with the external electrode placed in such a position that the current will pass through the greatest part of the tumor. This method should be begun at the earliest practicable moment after the preceding method has established the confidence of the patient.

The vaginal galvanic method of treatment to be employed, even in a desperate case of the kind we are now considering, is practically the same in its technique as the treatment of perituterine lesions of a chronic nature.

Prepare the carbon ball electrode in the usual manner by a protective mass of absorbent cotton-saturated in the hot-water solution of bicarbonate of soda. Insert it (either with or with-

out a speculum) as deeply into the vaginal cavity as it will go, and support it with regard to the patient's comfort during the

Fig. 219. Carbon ball electrode.

sitting. If the tissues are tender, sensitive to the pressure of the electrode, and irritable, connect the carbon ball with the positive pole at each sitting until these symptoms are removed.

If the tissues do not present the familiar indications for the positive polar action of the current it should be connected after the first sitting with the negative pole. The differential indications for choice of poles have been repeated so often that they can be employed with very great accuracy.

The invariable rule of *a gradual increase of current strength during successive sittings until the maximum of tolerance is reached* continues to hold good here.

The dose of either positive or negative current is raised evenly and gradually to the point of full comfortable tolerance of the tissues in contact with the vaginal electrode maintained at its maximum for about five minutes and gradually reduced to zero. The tolerance should gradually grow with successive treatments. If it does not the cause should be ascertained and removed by intercurrent methods of treatment, if it does not refer to some uncontrollable complication.

One of the greatest aids to removing localized and temporary congestions and mild degrees of simple inflammation which interfere with continuous high intensity galvanic currents is bipolar faradic sedation.

Fig. 220. Bipolar vaginal electrode.

While not expected to achieve a radical cure we possess in a combination of the above methods (supplemented by static electricity during later convalescence) the means of rescuing some of the most hopeless cases and benefiting almost every case which does not present fatal complications before treatment is begun.

If for any reason, in a rare case, an electrode can be employed in neither the uterus nor the vagina, it is still possible to employ an ordinary rectal electrode within the rectum and against the tumor while the positive large electrode is placed

Fig. 221. Rectal electrode, bare metal.

upon the abdomen. Always connect the rectal electrode with the negative pole if it is so employed. Owing to the large surface of this electrode the tissues will tolerate quite a large current without causing a burn, but care must be used to avoid injuring the surface of the mucous membrane while attempting to get a strong current through the tumor.

These methods are, of course, inferior substitutes for the classical intra-uterine application, but they are better than passive inaction, and contain potential possibilities of immense value to the patient.

Typical Varieties for Electrical Treatment.—The ordinary interstitial fibroid (including the intramural varieties also) constitutes probably 70 per cent. of the cases seen in practice, and although many approach a crisis which necessitates a surgical operation yet all of them that are uncomplicated with suppurating, cystic or grave lesions pass through a long career during which they are amenable to conservative treatment and form the classical field of action for the methods of Apostoli.

Various as they are in shape, size and symptoms, the intra-uterine method deals with them all upon the one principle that uterine tolerance is the key alike to contra-indications and

the efficacious dose, while the key to polarity is found in the hemorrhagic state and other familiar indications of endometritis.

These interstitial fibroids of all the kinds which are most completely benefited by electricity may be roughly grouped into two separate classes, one of which calls for the positive and the other for the negative local polar action, in chief. In both these groups however the indications for polarity vary and often alternate during the course of treatment, and when one pole is imperatively required at the beginning and constitutes the sheet-anchor of the whole plan the other will be found to be also a necessity during some part of any extended treatment of the patient. On this account and for other practical reasons the treatment of fibroid tumors of the uterus should never be the first work of the novice who has just purchased an electrical equipment.

No practitioner who is not experienced in the gynecological uses of electricity with high efficiency apparatus can expect to conduct advanced cases of fibroid tumors to a safe and satisfactory conclusion.

The two clinical subdivisions into which I shall now group fibroids which are most amenable to systematic electrical treatment are bleeding and non-bleeding.

Interstitial Indurated Non-bleeding Fibroids.—Taking these cases as they occur in practice, of all sizes and both with and without marked symptomatic disturbances, there is no doubt that the treatment of choice for the best interest of the patient is the classical Apostoli method.

The Apostoli galvanic treatment of fibroids aims at the symptomatic cure of the patient, with a limited retrogression of the tumor. It is based upon the different demonstrated actions of the two poles (positive and negative) together with the powerful *general tonic action* of the current and is applied, not indiscriminately, but with approximate exactness to meet the indications of each case—whether the fibrous or muscular structure predominates, whether the tumor is harder or softer, bleeding or non-bleeding, and with or without complications.

Uterine tolerance of the current is the key to contra-indications. This tolerance should gradually grow with successive treatments. It it does not the operator should find out the cause. The first thing of importance is to establish a complete diagnosis of the character of the tumor and the condition of the tissues. The next thing is the abatement of temporary or more acute complications, if any exist, and the last thing to treat is the tumor.

The first steps in every case of uterine fibroid treatment must be preparatory.

At the first examination of the patient in the class of cases we are now discussing initiate the medical and nutritional treatment which may be needed and give the patient the invariable preliminary *vaginal bipolar faradization.* The value of this will appear in practice.

Beginning with the first application of an induction coil current pursue exactly the same tentative steps described for the

Fig. 222. Bipolar electrode.

treatment of a "fibroid patient with suspected complications," for we must in all cases determine whether any contra-indications exist and what their nature is.

As soon as it is determined that no complicating lesion stands in the way of a systematic course of intra-uterine galvanic treatment proceed at once with the indicated pole, which is the negative.

Begin every treatment with an antiseptic vaginal douche, and carefully sterilize the electrode for the negative current is not germicidal. Employ two felt-covered, flat electrodes, 7 × 10, one upon the abdomen and the other beneath the sacrum, so that a large area of surface will permit the use of a large amperage without uncomfortable density. Always saturate

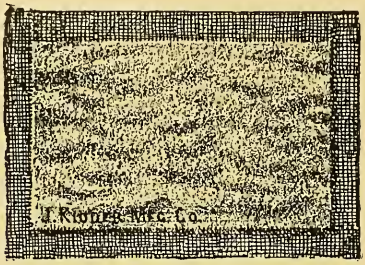


Fig. 223. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

the electrodes in a hot solution of bicarbonate of soda, about a teaspoonful to the pint of plain hot water. A speculum is not essential, but when it is not difficult to employ some operators prefer it. Some strongly advise against it. There is no reason why one should not be used if desired and practicable.

Make it a regular custom to place the external electrodes in position first, and irrigate next, so that the tissues will be softening for several minutes. This increases conductivity and lessens resistance. It is good practice.

After determining the depth, size and direction of the uterine canal select an electrode sound which will make metallic contact with the entire cavity, with the vaginal and external portion insulated. The usual zinc electrodes which every physician has serve the purpose admirably. The metal is not attacked by the negative current.

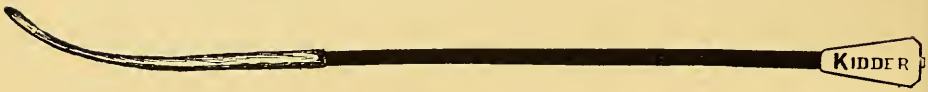


Fig. 224. Long tin tip intra-uterine electrode.

After inserting the electrode connect it with the negative pole, the external electrodes being connected to the positive pole by a bifurcated cord.

Gradually increase the constant galvanic current through the

rheostat from zero up to the full comfortable tolerance of the uterus, maintain the maximum current for about five minutes, and reduce gradually to zero.

In every case combine vaginal bipolar faradization with the galvanic treatment. If the patient is somewhat sensitive to the intra-uterine application and feels some discomfort this will be removed and tolerance increased by making the bipolar application *first*.

If the patient has her greatest disturbance after the treatment, and especially if these disturbances are neurotic, always administer the bipolar faradic sedation after the galvanic part of the sitting. The *management* of the treatment is as important as skill in the technique.

After withdrawing the electrode a second antiseptic douche is a precaution that is good practice.

If the patient returns home she should be advised to rest in a recumbent position for at least one or two hours, but a person with a very small fibroid, without symptoms, will need very little special care during a course of treatment, while a patient with an advanced fibroid, producing grave symptoms, will require to take every possible precaution to assist improvement.

Repeat the applications every second or third day when they are borne with perfect comfort, and gradually increase the amperage until about 100 mil. is reached, but on this point each patient is a law unto herself.

The sensibility of the uterus not only varies greatly in different fibroid patients, but in the same patient at different times. In some cases it is extremely insensitive and this accounts for the large doses of 150 mil. and upwards which have been many times employed. The uterus, however, is affected both by the general condition of health and by proximity to a menstrual period, hence the dosage at each sitting must be proportionate to the uterine toleration at the time, without regard to any other rule. The art of exactly regulating the delicate question of dosage in all cases under all the varying conditions of differ-

ent patients is not purchased with even the most scientific apparatus but is *training*, *skill* and *judgment*.

On account of its denutritive, softening, liquefying, and absorbing action, the negative pole is applied to non-bleeding and hard fibroids, to those in which menstruation is painful while not abundant, and also to painful fibroids in alternation with positive applications when these are indicated in chief but do not relieve the pain.

If any aggravation occurs after any negative application with a somewhat excessive dose allow two or three days' extra time before the next intra-uterine treatment, and meanwhile repeat vaginal bipolar faradic sedation. Following this, it is a safe rule to make the next intra-uterine application with a smaller dose and with the positive pole of the galvanic current.

The number of sittings required for a given patient can be fairly estimated by practical experience. It depends upon the kind of fibroid, its chronicity, its susceptibility to electrolytic action, the age of the patient, the severity of the symptoms, the state of her general health, and the regularity and thoroughness with which she is treated.

In all cases in which the patient is hysterical, neurotic, neurasthenic, anæmic, subject to pains and aches, muscular rheumatism, palpitation, insomnia and other derangements not directly due to pressure, the immense help of static electricity should constitute an active part of the treatment. It is, of course, impossible to repeat under each section the directions for relieving all the host of symptoms which arise during a long term of ill-health, but the reader will find explicit instructions for the use of this agent in the chapters devoted to the separate symptomatic manifestations which each patient brings to the office.

When a patient has been successfully treated by the above methods for two or three months, she will enquire how long treatment must be continued. If the fibroid is a small one, and without marked symptoms, a moderate amount of treat-

ment will suffice to establish the general health in the best possible condition and practically insure an arrest of growth and slight reduction of the tumor.

If the patient wishes to stop treatment when this point is reached she can safely do so, with instructions to return in two or three years, if at any time in the future she is admonished by signs that the tumor has again started into activity. It will be least likely to do so if she maintains her general health.

If she wishes to persist with a view to testing the possibility of obtaining an anatomical cure the treatment may be continued as long as the judgment of the physician deems it beneficial.

If the patient is an advanced case, and neither expects nor desires much help beyond relief from troublesome symptoms, the duration of the treatment is governed more by her convenience, wishes, and possibly by financial circumstances than by theoretical considerations. If her symptoms are abated, and she lives a comfortable life for a few months at a time as the result of a few occasional applications repeated whenever needed, this may be satisfactory to some, while others would wish to exhaust every resource of conservative methods to obtain as near a radical cure as possible.

Interstitial Bleeding Fibroids.—Perhaps the most useful services rendered by electrical currents in the treatment of benign tumors are achieved in the control of the two great symptoms, pain and hemorrhage, which, more than any others, attract the patient's attention and cause her to consult medical aid.

The cheering fact is demonstrated by clinical experience, covering now about fifteen years and a very large number of cases, that if the full resources of induction coil currents, galvanic electrolysis and metallic electrolysis are employed with reasonable skill, these symptoms will be controlled and a curative process inaugurated in all but a very few cases which will prove to require operative measures.

The first steps of treatment must be influenced somewhat by

the activity of the hemorrhage, the state of the patient at the first sitting and by the nature of the tumor.

If the patient is losing blood at the time of treatment it is not wise to begin with the most energetic treatment, unless this is imperatively demanded, because it is the cardinal rule in careful electro-therapeutics to begin gently and develop maximum doses gradually.

If the patient is simply oozing from general atonicity of the enlarged, soft, uterine tissues the first application may wisely make a trial of the method employed in post-partum hemorrhage. (See Index.)

When one, two or more tentative trials of this method prove that it will partly but not wholly arrest the oozing, another external and useful method is *percutaneous galvanism* with the positive electrode on the abdomen and the negative beneath the sacrum.

By a careful study of the directions previously given for the treatment of hemorrhagic states of the uterus and of the treatment of a fibroid patient with various degrees of hemorrhage before a complete diagnosis is made (see Index), the physician will be able to select and employ the method best adapted to different cases, so that it is unnecessary to repeat the same directions here. It is always advisable to consider the state of general alarm and mental collapse so often associated with severe hemorrhage, and for this reason it is best to reserve intra-uterine applications until at least confidence is restored and some improvement effected by the simplest external or vaginal methods; for these not only may do much to control the bleeding, but will produce a general sedative-tonic effect of immense value to the patient.

From the moment the symptom of bleeding is under control between menstrual periods the permanent plan of treatment in this class of cases proceeds along the lines of vaginal bipolar faradization combined with positive galvanic or metallic electrolysis for local administrations and employing the full resources of static electricity for its general nutritional, tonic and

sedative effects, together with its great power over reflex and functional symptomatic disturbances, especially those of nervous irritability and pain.

The technique of the intra-uterine treatment which is now commenced is really the treatment of *endometritis* with practically the same indications for polarity and electrolytic action but with the dose increased to the point of denutritive action.

If the patient is treated at the office she is placed in the usual dorsal position upon the operating table. If her conditon has confined her to the house she should be placed in the obstetrical position across the bed, knees flexed and apart, muscles all relaxed, and the buttocks well advanced and extending over the edge of the bed so as to afford the physician facility to manage the intra-uterine electrode.

Place the large felt-covered, flat electrodes, 7 × 10, in the hot-

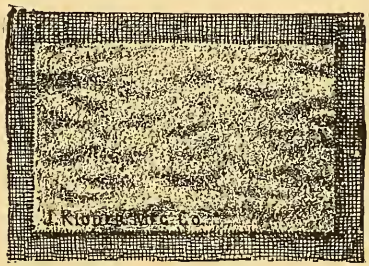


Fig. 225. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

water solution of bicarbonate of soda, press them only moderately dry, and transfer as hot as the skin will tolerate, one to the abdomen and the other to the lumbo-sacral spine. Connect them by a bifurcated cord to the negative pole of the galvanic battery.

In addition to the protection afforded by the soft rubber backing of these electrodes the clothing of the patient should be protected from dripping water by folded towels.

The weight of the patient will secure firm contact with the posterior electrode but the abdominal contact must be main-

tained by moderate pressure of the hands or by the weight of a small pillow containing sand or shot. Next give the usual antiseptic vaginal douche.

The next important step is the selection of the internal electrode and the choice of method.

If an uncomplicated condition is present and the operator can insert a platinum or tin sound electrode so as to make good contact with the entire canal this is ordinarily done.

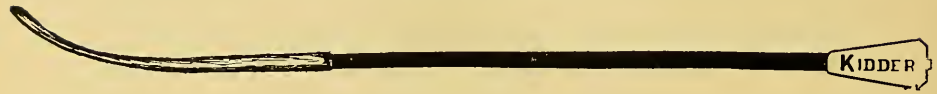


Fig. 226. Long tin tip intra-uterine electrode.

If the endometritis is catarrhal, with profuse leucorrhœa, or especially if profuse discharges are purulent, the non-attackable electrode should be laid aside and *metallic electrolysis* employed.

If the canal is accessible throughout its entire length select as large a zinc electrode sound as can be inserted and amalgamate it with mercury.

Fig. 227. Zinc electrodes : insulated with soft rubber tubing to expose any desired surface.

If the tortuosity of the canal prevents a complete application to its entire surface it must be done by the familiar sectional method. For this purpose select one of the set of zinc tips and amalgamate it with mercury.

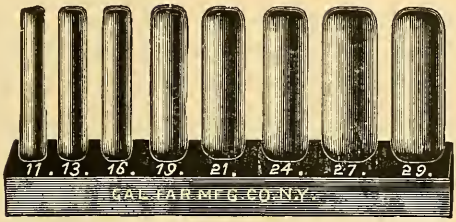


Fig. 228. Set of copper or zinc bulbs.

Handle for same.

We thus have at command three variations of method for the employment of positive galvanic currents which survive the experimental methods of the past ten years. The reader is probably most familiar with recommendations of carbon and copper electrodes for sectional cauterization, and of copper sounds for metallic electrolysis and the control of catarrhal inflammations, but in the opinion of the writer these give place to the better clinical method of zinc-amalgam electrolysis for a knowledge of which the author is indebted to the writings of Dr. G. B. Massy. Experience with this method in my own clinic during the past winter has been sufficient to enable me to recognize its value.

Prior to inserting the intra-uterine electrode, whichever kind is selected, a preparatory application of bipolar faradic sedation must be made if the tissues are sensitive, irritable and inclined to muscular spasm, etc.

At every insertion of the intra-uterine electrode the greatest possible gentleness is the invariable rule, and if the electrode does not at any given application reach the fundus, do not use forcible pressure but support the electrode at the depth attained and proceed with the administration. Also aid insertion by a mild negative current as described under Stenosis.

All the portion of the electrode outside of the external Os must always be kept from contact with the vaginal tissues

and this is usually accomplished by either a sliding insulating sheath or by employing electrodes with hard rubber handles.

A platinum electrode needs no preparation beyond passing it through the flame of ignited alcohol, but electrodes for metallic electrolysis must always be freshly brightened with fine emery paper, and the zinc-amalgam surface must be prepared at the moment of use.

With the electrode now successfully inserted within the uterus and connected with the positive pole increase the constant galvanic current through the rheostat from zero until the meter registers 30, 40 or 50 mil. according to the present degree of tolerance.

In a moment again cautiously increase the current strength until the patient begins to express discomfort. Pause at this point to observe if this sensation quickly disappears or tends to increase. If the tolerance proves to be normal maintain the current at the maximum point for about five minutes and reduce gradually to zero. If however the discomfort does not at once disappear deduct a few milliamperes from the dose and then continue the application in the usual manner.

After reducing the galvanic current to zero it is good practice to always complete the sitting with bipolar faradization

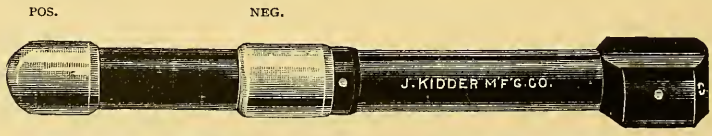


Fig. 229. Bipolar vaginal electrode.

for either sedative effects to allay any post-operative irritation, or for its valuable influence upon the muscular fibres and vessels within the pelvis.

After the bipolar application the felt electrode can be removed, the skin dried and dusted with toilet powder, and the treatment closed.

Repeat at intervals, which may vary from two to four days according to the local condition, the convenience of the

patient, and the amount of amperage the operator is able to employ. High intensities will accomplish sufficient effect to make frequent treatment less necessary, but if doses of 100 or more mil. are not tolerated after a half-dozen sittings the effects of much smaller amperage will not only be slow as a rule, but will require a repetition about every second day in order to make progress.

The above relates to treatment between menstrual periods. If menstruation lasts much more than an ordinary time, and is excessive, the patient should never wait until she is entirely well, but some of the other methods above described should be employed regularly during menstruation, and if the flow is not sufficiently modified thereby an intra-uterine application should be made after a reasonable time to bring it to a stop.

Owing to the powerful muscular contractions set up by strong currents of the positive galvanic pole the patient is much more apt to experience lumbar and abdominal pains after treatment than when the negative pole is employed. These are prevented or modified to a great extent by bipolar vaginal faradization.

As soon as the chief conditions which supply the well-known indications for positive polar action are progressing with satisfactory improvement we must consider special and minor indications for the intercurrent use of negative electrolysis.

No case can be treated long by either pole alone, for pathological conditions are seldom so simple as to be combated by a single remedy. Study the differential indications described under the different complications throughout these chapters. If pain continues to be a marked symptom despite bipolar faradization and positive intra-uterine applications after hemorrhagic tendencies are controlled it often yields to an intercurrent treatment with the negative pole, for it may be dependent upon causes which the positive electrolytic action does not reach.

The control of severe symptoms in these cases depends

greatly upon their character. Those of nervous origin yield readily, but those most influenced by mechanical pressure in the case of a large tumor will be slow to abate. It is the usual rule to find that patients with general ill-health and a great variety of symptoms obtain rapid improvement in some respects, but that in other respects they must wait several months before satisfactory progress is made. Very old tumors and those least accessible to the operator must naturally wait the longest for maximum results.

Cases in which a Sound Cannot be Inserted into the Uterus.—Uterine hemorrhage may be successfully arrested without introducing the sound electrode into the uterus, simply through its tonic action upon the muscular fibres and vascular walls of the uterus, and action sufficient to partially control the blood supply to the engorged mucous membrane, but this method of employing the galvanic current is much slower and less decided in its results than the direct coagulating action of the positive pole. However, during the past ten years, the vaginal application has proved to be a resource of priceless value, both in cases in which the sound will not enter the uterus at all and in cases in which temporary emergencies require the substitution of an intercurrent method.

The technique of this former treatment is fully described in connection with inoperable cases and need not be repeated here, but it is more valuable in proportion as it is employed before the state of the patient becomes desperate.

As some writers consider fibroid tumors among the principal causes of menorrhagia, and as the removal of the appendages was formerly a panacea (?) for both the hemorrhage and the fibroid (a panacea now greatly discredited because of its many failures), it is reassuring to know that the hemostatic action of the positive galvanic current is one of the most thoroughly demonstrated facts in either operative or medical practice.

No other means short of complete hysterectomy can be considered more certain.

Remarks.—In the treatment of all patients of this class the

first thing to do is to improve the general state of health and the quality of the circulating fluids by every possible means—fresh air, gentle exercise, nutritious food and the best resources of the *materia medica*. Before any local application of electricity is made the appropriate medical prescribing should be attended to and constipation relieved. It is one of the fundamental rules of vaginal bipolar faradization and all other methods of employing electric currents within the pelvis to first have the rectum emptied.

Throughout all that part of treatment, which aims to build up the general health and relieve many of the symptomatic disturbances, the static apparatus is our sheet-anchor. The static administration may be given after the local treatment, but should also be made on intermediate days during the first few weeks. It is important in all those cases to get the patient well started on the road to improvement, and a good beginning is made by encouraging the nutritive processes in every possible way.

The treatment of a large fibroid tumor, from start to finish, is a liberal education in electro-therapeutics, and while the road to the same end may be somewhat longer by this means than by cutting operations, the two methods cannot be compared, for they do not properly include the same cases.

When the best interests of the patient demand a surgical operation the patient may decline it, and be within her rights, but we have no argument to offer against surgery on that account. If we offer a substitute method in order to do the best we can under the circumstances, we do not put electricity forward as superior to any method which is better indicated in the case of a given patient.

But many cases do not require surgery. Even in cases of diseased appendages an observation of the clinic of the greatest ovariotmist the world has ever seen proved that he sent but one-fourth of these patients to the operating table, and it is a well-known fact that a great many women who figure in surgical tables as recoveries, as against deaths, absolutely

refuse to regard themselves as cured, but, on the contrary, even claim to be worse.

It is in cases of pelvic lesions which are not malignant or threatening to life and in which common-sense dictates that conservative measures ought to be exhausted before surgery enters into legitimate consideration that medical, nutritional, hygienic, and electrical measures come to the front as the best that we can offer the patient in the present state of the world's medical knowledge.

Finally, in estimating the pros and cons of electrical treatment in either simple or desperate lesions of the pelvic organs it is proper to consider that if the patient refuses operation, or resides where the requisite surgical skill is not obtainable, or is prevented by circumstances from availing herself of the services of a surgeon in whom she would feel perfect confidence, and if facilities for electrical treatment are at hand, then it may be rationally advised regardless of whether the knife would be better and quicker or not.

It is one of the practical possibilities of every-day experience that the circumstances of the patient and the armamentarium of the physician may both render electrolysis feasible when surgery would be out of the question. In saying this we need place no emphasis upon the well-established fact that the medical gynecologist with reasonable skill in the use of up-to-date electrical apparatus can often produce better clinical results than can the most skilled gynecologist or the best surgeon without the assistance of electricity.

In behalf of the patient it remains to be said that early recognition and early treatment of benign tumors of the uterus will secure relief at a time when it is most easily given, and the early treatment of interstitial fibroids has the advantage of placing all cases within the curative action of electricity, while delay not only permits the increase of size which constitutes a barrier to the most satisfactory treatment, but affords the opportunity for cystic and other degenerative changes which may place the patient beyond the reach of its action alto-

gether; for tumors that have undergone cystic or purulent degeneration, or that are surrounded by a purulent process, should not be treated with electricity in the hope of a radical cure.

External Method of Treating Fibroids.—Although Apostoli effectually displaced surface methods of treating fibroids by electricity, and improved surgical methods now make it less necessary to pursue inferior and tedious procedures, yet it may be useful to some who are not confident of their ability, or are without the resources to pursue the methods heretofore described, to cite a less efficient substitute method which was formerly much used. In our larger cities and within reach of medical and surgical facilities no one would be justified in going back to a primitive although safe method, but there are regions of our great country in which women are beyond the reach of the apparatus and the skill which afford the best relief, and any means of producing good results is better than passive inaction and hopeless suffering.

Procure a felt-covered, flat electrode, 7 × 10, moisten it thoroughly in a solution of bicarbonate of soda, a teaspoonful

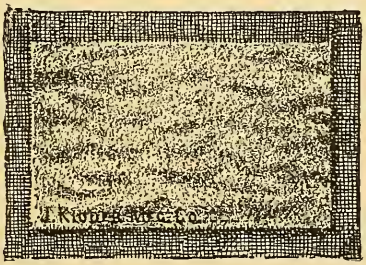


Fig. 230. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

to one pint of hot water, press it moderately dry, and place it underneath the lower spine with the patient recumbent in the dorsal position. Protect the clothing of the patient by folded towels outside of the electrode.

Procure a round hand electrode, about three inches in diameter, the base of which may be either carbon or metal.

Fig. 231. Felt or sponge covered flat electrode, assorted sizes.

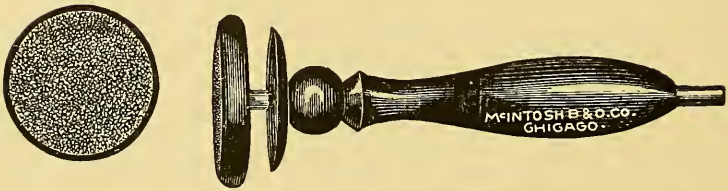


Fig. 232. Carbon disk electrode.

Wrap over this a thick layer of either absorbent cotton, or electrode felt, or soft sponge, and moisten this material thoroughly in the hot bicarbonate of soda solution. Connect it with the negative pole of the galvanic battery and attach the posterior electrode to the positive pole. During a course of treatment this polarity may be alternated. It is also a good plan at the beginning of treatment to connect the positive pole with the electrode upon the abdomen if this is sore and tender to pressure.

Request the patient to deflate the lungs to the fullest possible extent and retract the abdomen. Press the hand electrode firmly down upon the tumor through the abdominal tissues and maintain it firmly in position while the patient again breathes regularly. Gradually increase the constant galvanic current until the meter registers the greatest amperage that can be comfortably tolerated. If the skin is not irritated, or if any point of eruption is first covered with a protecting

layer of rubber plaster, the dosage should reach from 40 to 60 mil. As this method acts slowly maintain the constant current for about twenty minutes, then reduce gradually to zero and close the treatment with an interrupted galvanic current. If the apparatus contains no automatic rheotome make the interruptions by hand, making and breaking the contact at either pole. Make 40 or 50 interruptions per minute with the current gradually increased from zero until it produces vigorous contractions without any sense of pain. Repeat the applications two or three times a week between menstrual periods. After removing the electrodes dust the skin with toilet powder.

Of this method Everett says: "In a list of forty-seven uterine fibroids so treated the writer has a record of forty-three cures either by absorption or by disintegration. Of the remaining four cases two were improved considerably and two proved to be malignant."

The interpolar nutritional and tonic action of the galvanic current is a very decided addition to merely medical treatment, and by closing each sitting with powerful contractions another element of benefit is secured. If the physician also possesses and knows how to use a high-tension induction coil apparatus, a vaginal bipolar electrode, and a carbon ball electrode for intra-vaginal galvanic applications and will support these

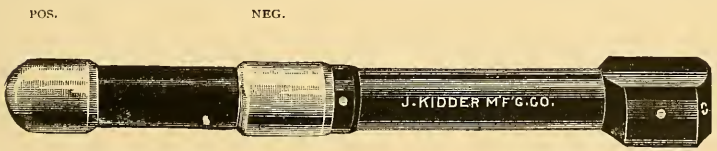


Fig. 233. Bipolar vaginal electrode.

Fig. 234. Carbon ball electrode.

measures by rational hygiene, nutrition and medical prescribing he can do pretty well for the average patient, even though remote from any of the chief centres of civilization and located in any part of the country however distant.

Vaginal and Abdominal Puncture.—The accepted and universal methods of managing the electrical portion of the conservative treatment of benign tumors are those described in this chapter. During the early period of experimental technique much was said about the advantages of localizing electrolytic and destructive action by means of needle puncture. Some practitioners may obtain the idea from reading that they cannot treat a fibroïd tumor at all unless they thrust one or more needles into its mass. This reasoning is not true, and at the present time methods of puncture should be reserved for exceptional cases and employed only by men of long experience who have ceased to require any instruction from a text book. It is safe to say that no practitioner who is obliged to *read* the technique of vaginal puncture should employ it. For this reason no description of these methods will be inserted in this book.

CHAPTER XXXII.

TREATMENT OF GENITO-URINARY CONDITIONS.

Sexual debility in the male. Spermatorrhœa. Treatment of complications. Treatment of irritable stage. Treatment of post-irritable and paralytic stage. Functional sexual debility in the male. Symptomatic impotence. Irritable atonic impotence. Treatment of different stages. Psychical impotence. Paralytic atonic impotence. Atrophy of the testicles. Sexual hypochondriasis.

THE electrical portion of the treatment of the usual forms of sexual debility which are correctible by the general practitioner, either without surgical interference or after necessary operation, can be simplified into three prominent methods, although a great diversity of minor variations are recommended by different writers.

1. Local and spinal tonic-sedation with the high-tension, rapidly-interrupted induction coil current.

2. Nutritional and vitalizing or sedative applications of the galvanic current to the spine and genital organs.

3. Local and constitutional, tonic and nutritional applications of static electricity.

The number of slightly different methods which carry out these leading principles in detail described by various authors, especially those of the German and French schools, tend to confuse and perplex the average physician, who may be still further disappointed because his results do not equal the cures he reads about. The attractive stories set forth by genito-urinary charlatans about the magic action of electricity in these cases are not the measure of either their own results or legitimate clinical experience. Despite electricity many patients leave the hands of these men minus their money and without perceptible benefit.

A conservative prognosis, both as to final results and length of time required, will save much disappointment to all concerned, for while the effects of electrical treatment in skilful hands are often brilliant, such effects cannot always be duplicated even by experts. By others of less experience who may less readily recognize the indications and less thoroughly adapt the method to the case, the average success obtained may be only fair. Finally, some cases will prove so impatient and unreasonable that the physician tires of further efforts and prefers to abandon treatment rather than pursue it a sufficient time.

Hygiene and both local and general therapeutics in their broadest sense are of paramount importance in the treatment of these patients. Merely local measures, whether surgical, mechanical, medical or electrical, will deserve to fail, as they nearly always fail, when treatment is conducted upon narrow lines. There is a general belief that electricity is of peculiar benefit in functional derangements of the sexual organs, and the belief is theoretically sound, but in practice the prevailing ignorance of electro-physiology, the employment of crude apparatus, incompetent and improper methods, discredit the true value of this great agent.

There is also an ill-advised idea on the part of patients that self-treatment with an electrical battery will be both successful and economical. Much money is wasted in belts, and various devices masquerading under the general name of "electricity" without any of the therapeutic properties pertaining to high efficiency apparatus in the hands of competent physicians. The laity fail to recognize that electricity is but one of many weapons with which the practitioner combats disease, and it cannot alone displace all other resources of medicine in the management and treatment of sexual debility.

Self-treatment is practically impossible, and the purchase by patients of any kind of electrical battery or appliance for home use cannot be recommended.

Spermatorrhœa.—*First stage.*—For the purpose of describing treatment we may include all cases of nocturnal emis-

sions which call for treatment, however they may differ as to cause, frequency, duration, state of general health or effect upon the nervous system, prior to the time when the irritable or first stage of impotence ensues.

When there is present a hyperæsthesia of the whole sexual apparatus the treatment should be directed to overcome this irritable state and to build up the general health. The local applications of electricity may be as follows:

Galvanic.—Treatment may be initiated by the method described in a following section for debility, substituting the positive pole in the water bath electrode and placing the electrode upon the spine. The technique of making the application and regulating the dose is exactly the same. The value of static electricity also in toning up the system is of much greater value in these cases than some of the fantastical suggestions for awakening the patient at a critical time. I have seen young men who had been tormented and impaired in health by strict regimen and interference with their sleep rapidly improve under tonic treatment with instructions to eat what they chose and sleep all they could.

Faradic.—When hyperæsthesia of the deep urethra and seminal ducts exists it is well to first try a simple method of sedation before inserting an electrode into the irritated canal.

Place the patient in the dorsal position upon the operating

Fig. 235. Electrode insulated on under half.

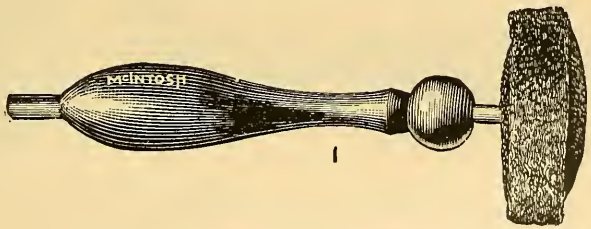


Fig. 236. Sponge-covered hand electrode.

table. Connect a rectal electrode with the negative pole of the high-tension induction coil apparatus and insert it against the prostatic portion of the urethra. Press any ordinary sponge-covered hand electrode firmly upon the anterior perineum with the scrotum drawn forward by the patient out of the way. Connect this with the positive pole. Switch into circuit the 1,000 yard No. 36 coil rapid vibrator and four cells, regulate the current strength through the secondary rheostat from zero up to agreeable tolerance—until a strong and comforting grasp upon the tissues is maintained. In about five minutes slightly increase the current and in five minutes more begin to very gradually reduce it. Spend three or four minutes reducing the current from its maximum point to zero. Never shut off a sedative current abruptly.

Spinal application of coil currents by the same method as described in the treatment of lame back (which these patients often have) are also wonderfully sedative and restful.

If a *stricture* exists and electrolysis is preferred by the reader to division or dilatation it should be one of the first steps of treatment. The method is described in full in another section to which the reader is referred.

Ulcerated patches.—The treatment of these must precede a final cure. Apply upon the convenient side of the groin a carbon hand electrode covered with a layer of absorbent cotton well moistened in the usual hot-water solution of bicarbonate of soda. Connect this with the positive pole of the galvanic

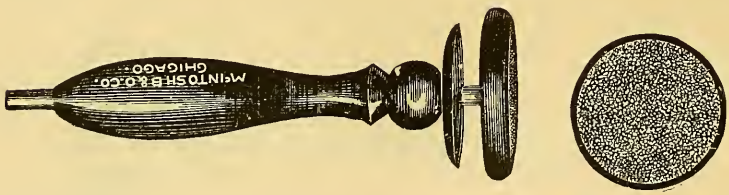


Fig. 237. Carbon disk electrode.

battery. Select a urethral sound electrode with an insulated handle, lubricate it with glycerine, connect it with the negative pole and insert it to the sensitive region.

Increase the constant galvanic current through the rheostat from zero to 3 or 4 mil. and maintain this small current for from two to five minutes according to the sensitiveness of the urethra. Reduce to zero before withdrawing the electrode. Repeat this application two or three times a week. If the lesion is limited to a small spot use an olive-tipped electrode in the urethra.

If the irritation is extreme repeat the applications only once a week. When there is no morbid sensitiveness the application may be made daily for a few times until healing is advanced.

Paresis of the seminal ducts remaining after irritability has been allayed.

Faradic.—Insert an ordinary rectal electrode with insulated

Fig. 238. Rectal electrode, bare metal.

handle to a point above the prostate. Connect it with the negative pole of a high-tension induction coil apparatus.

Fig. 239. Ordinary sponge-covered hand electrode.

Press a sponge-covered hand electrode connected with the positive pole firmly upon the anterior perineum. Switch into circuit the No. 21 and the 800 yard No. 32 coil, three or four cells and the rapid vibrator. Gradually increase the current strength through the secondary rheostat from zero to the

point of agreeable tolerance. Maintain the action steadily for five minutes. Close the sitting by making a few successive strong contractions through the parts by switching the slow vibrator into circuit.

Repeat daily or every other day for a sufficient time.

Galvanic.—Moisten a felt-covered, flat electrode, about 4 × 6,

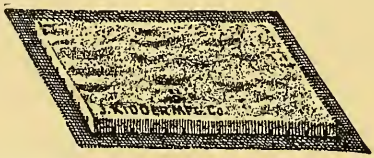


Fig. 240. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

in a one or two per cent. hot-water solution of soda-bicarbonate, connect it with the positive pole of the galvanic battery and place it under the lumbar spine with the patient in the dorsal position on the operating table.

Lubricate an ordinary urethral electrode with glycerine and insert it to the prostatic portion. Increase the constant galvanic current from zero to three or four mil. In five minutes reduce to zero, next finish the sitting by giving the patient a thorough spinal treatment with static counter-irritation, or if the physician unfortunately does not possess this apparatus (which is an indispensable part of every complete electro-therapeutic equipment) pass a tonic galvanic current down the length of the spine.

Moisten two similiar felt-covered electrodes 4×4, place the positive at the back of the neck and the negative on the sacrum. Gradually increase the current from zero up to about 20 mil. In five minutes reduce to zero and close the sitting.

Intra-urethral applications of the faradic current are often recommended although accompanied by alarming cautions about the danger of setting up a urethritis and exciting pain. It is evident that almost all these old outstanding recommendations refer to currents from the common faradic battery, an utterly worthless thing which should never be employed as a

medicinal agent. The therapeutic currents from high-tension induction coils applied for sedative or sedative-tonic effects by any physician far enough advanced in electro-therapeutics to adjust a dose to cause a given effect will never produce either pain or urethritis.

A very considerable number of cases have reported to me that they have been treated locally by doctors who inserted a sound, used a small battery that made a buzzing noise and hurt them a good deal without doing them any good. My own opinion is not favorable to early and aggressive intra-urethral stimulation for atony and relaxation of the ejaculatory ducts and seminal vesicals. The rectal-perineal application described in paragraph above is preferable in every way. There is almost no possibility of doing any harm and it is entirely comfortable to the patient. The current from the high efficiency coil pouring into the tissues with its intensely rapid succession of high potential impulses is the most powerful and certain vasamotor constrictor we possess. It will tend to unload the congested capillaries, lessen the sensibility of the urethral nerves, and by simple manipulation of the technique can be varied in effect from sedation to tonic and powerful stimulating action.

Independent of the particular local application however the spinal and general tonic employment of electricity is nearly always indicated and will be productive of good.

Irritable or Spasmodic Stage of Spermatorrhœa.—Remove any source of reflex irritation that a careful examination can discover. Attend to hygiene and general health in the usual manner.

Galvanic.—Immerse the entire organ as deeply as possible in a small bowl or jar filled with a semi-saturated solution of rock salt. Connect this water-bath electrode with the negative pole of the galvanic battery. Moisten a large sponge (about the size of the palm of the hand) in a one per cent. hot-water solution of bicarbonate of soda and fold it over a carbon hand electrode connected with the positive pole.

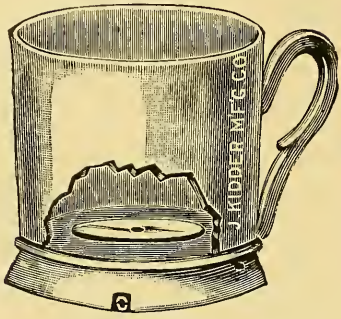


Fig. 241. Water-bath electrode.

Apply it to the lumbar spine and regulate the constant galvanic current through the rheostat from zero up to 15 or 20

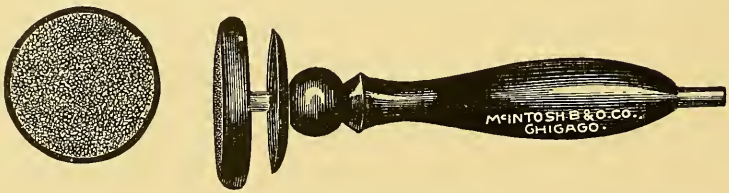


Fig. 242. Carbon disk electrode.

mil. or just sufficient to produce a sensation of comfortable warmth through the tissues. Move the positive electrode slowly across the entire lumbar region a number of times, then up and down the spine for about two minutes and finally hold it steadily upon the cillio-spinal centre for three minutes. Reduce the current to zero and withdraw the electrode.

Repeat daily at first and later three times a week. This method will give valuable assistance to other measures in allaying the local and spinal irritability and will act as a general sedative-tonic.

Faradic.—Another method which I have found excellent as a sedative-tonic in the spinal irritability and backaches of these cases is as follows:

Have the patient disrobe to the waist and repose face down-

ward upon the operating table, or couch, with complete relaxation of all the muscles.

Select two similar sponge-covered hand electrodes of the

Fig. 243. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

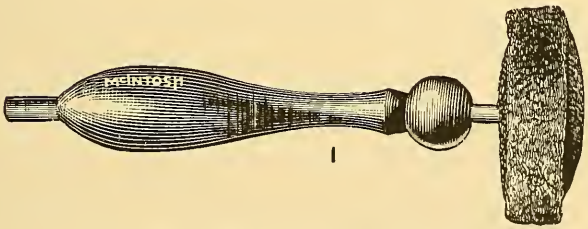


Fig. 244. Sponge-covered hand electrode.

ordinary size, moisten them in hot water and lubricate both with a little soap; connect them to the opposite poles of the high-tension induction coil apparatus. Switch into circuit the 800 yard No. 32 coil, the rapid vibrator and three or four cells. Place the electrodes in contact with the skin upon any point of the spine and regulate the current strength until it produces an agreeable tingling sensation with the electrodes in the median line, or mild muscular contractions when one electrode is passed over the muscles of either side.

Having regulated the dose, hold the positive electrode steadily upon the back of the neck and promenade the nega-

tive with medium rapidity up and down the middle line of the back for a couple of moments. Next promenade it across the lumbar region, and if any points of tenderness are discovered pass the negative electrode a few inches below and bring down the positive to the tender place.

Hold the electrode stationary upon the part, increase the current strength gradually to the point of maximum tolerance and maintain the action until sedation is complete. After controlling all local sensitiveness promenade the positive electrode over the motor points of all the muscles of the back while the negative is held upon the sacrum. No chart of motor points is required. Simply move the electrode about the surface, and whenever it passes over a motor point a vigorous contraction will be produced, and this furnishes the desired nutritional exercise without a chart.

After about ten minutes devoted to the entire application stop the current, dry the back with a rough towel and anoint the palms with a little vaseline. For two or three minutes give the spine vigorous massage from above downward and across the lumbar region. Then rub the back briskly with a coarse towel and the patient is ready to dress.

This application elicits expressions of great appreciation from the patient. Usually some backache has been present, and in fact this is one of the chief indications for using this method. The backache is immediately removed and the patient generally "feels as if made over new." The whole effect is soothing and gratifying. It promotes sleep. Either in these cases or in the case of nervous women who are troubled with lame backs it is one of the most composing, restful and re-invigorating applications that can possibly be made with faradic currents.

Post-irritable and Paretic State of the Lumbar Centres.—*Galvanic.*—Proceed as in the previous irritable state but reverse the polarity. Apply the negative electrode to the spine and connect the water-bath electrode with the positive pole. Increase the current strength to the full comfortable tolerance

of the skin and make a more vigorous labile application to the spine.

Static.—Either in alternation with galvanic treatment of the spine in this stage, or without the galvanic current at all, we may administer energetic tonic stimulation to the spinal centres without the inconvenience of removing the patient's clothing.

Seat the patient upon the static platform connected with the negative pole, ground the positive pole and ground the brass point electrode.

After three or five minutes of simple electrification to accustom a new patient to the apparatus and explain to him what is coming, for a new patient should never be startled by local applications which he is not prepared for, apply a tonic breeze to the spine and gradually increase it to a stimulating spray. Next exchange the point for the brass ball electrode, and stimulate the spinal centres both of the lumbar and cervical regions with mild positive sparks and frictions.

The efficiency of static electricity as either a sedative, or tonic, or stimulant, to the spinal centres practically does away with the need of the more troublesome methods of applying moist electrodes to the spine. In repeating sittings the nutritional spray and mild spark may be extended by the operator to the extremities and over the abdomen. Mild counter-irritant frictions are exceedingly useful to interpolate at each sitting. They will warm and set the whole surface in an agreeable and lasting glow.

Conjointly with this treatment the value of iron, cinchona and the compound syrup of hypophosphites should not be overlooked.

In all these cases, of whatever variety, it may be considered that if the general health is good the chief indication is for local treatment, while if the general health is poor the constitutional portion of the treatment is of equal, or greater, importance.

Functional Sexual Debility in the Male, Excluding Cases

Associated with Central Lesions, Senility, Malformations and Injury or Disease of the Testicles.—*Galvanic.*—Seat the patient upon the forward edge of a high stool with clothing removed from the upper portion of the body. Fill a small bowl nearly full with a semi-saturated solution of rock salt in tepid water. Connect this by a conducting cord to the nega-

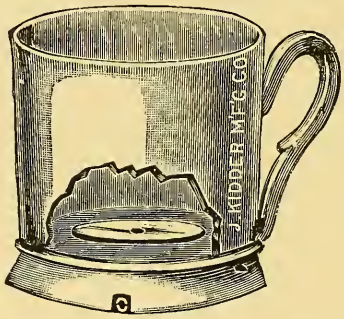


Fig. 245. Water-bath electrode.

tive pole of the galvanic battery and have the patient support it with the entire organs deeply immersed.

Wet a large soft sponge with the usual hot-water solution of bicarbonate of soda and fold it over a carbon hand electrode

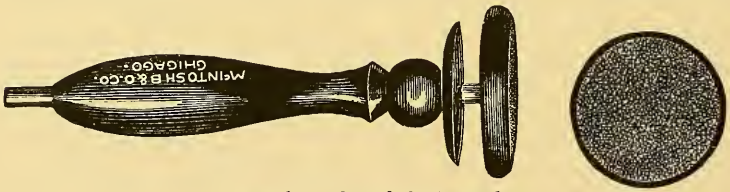


Fig. 246. Carbon disk electrode.

connected with the positive pole. Apply the hand electrode to the back of the neck while adjusting the dose. Gradually increase the constant galvanic current from zero until it produces a tingling sensation upon the skin which does not exceed comfortable warmth. If the skin is not irritable the meter will register about 20 mil. If the back is scratched or filled with small eruptions the application can hardly be made until these are healed, for even five milliamperes will be un-

comfortable in this case. If a single eruption is observed at any point it can either be avoided or covered with a piece of plaster.

Having adjusted the dose, promenade the positive electrode slowly over the different portions of the spine, devoting about five minutes each to the cervical and lumbar region.

Repeat daily or three times a week as circumstances permit, and prescribe appropriate medication for constitutional effects.

Static.—It is useful to obtain intercurrently, or at the close of the galvanic *séance*, the tonic and nutritional benefits of static electricity which produces *general* effects much more rapidly than the galvanic current.

Seat the patient upon the static platform connected with the positive pole. Ground the negative pole and the multiple point electrode. Start the machine into moderate action, and after the patient is accustomed to general electrification and is prepared by a word of explanation for local treatment apply to the spine, and especially to both the lumbar and cervical centres, a strong breeze which gradually merges into an active counter-irritant spray interspersed with an occasional spark. Next produce the same counter-irritant effect across the lower abdomen.

Next stop the machine and change the platform connected to the negative pole. Ground the positive pole and the brass ball electrode. With the machine in moderate action apply mild sparks to the limbs and posture the patient so that a few are directed to the perineum.

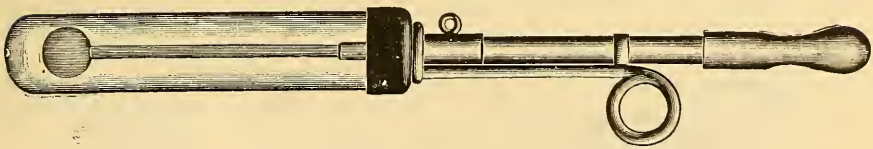


Fig. 247. Insulated spark electrode.

If local anæsthesia of the parts exists apply fine rapid needle-like sparks from the brass point electrode to the benumbed areas until sensation is restored.

Repeat these administrations several times a week, the oftener the better until improvement is satisfactory.

Symptomatic Impotence.—Local treatment of a subordinate symptom must of course be preceded by attention to the chief disease. The functional failure in these cases must be regarded in the same light as amenorrhœa in certain diseases, *i. e.* as a conservative act of nature which does not require treatment apart from the general health.

Irritable Atonic Impotence.—*First stage.*—The first indication is to allay the irritable state of the nerve cells of both centres and periphery and give complete rest to the organs involved. When irritable and fruitless erections are temporarily stopped strength can be stored up for future usefulness.

In addition to the removal of all local sources of irritation, if any exist, direct hygienic and medical measures to upbuilding the general health. The most important auxiliary aid will be derived from daily nutritional administrations of static electricity.

The local electrical treatment, after careful attention to all existing complications, may begin (barring stricture) by the intra-urethral applications of negative galvanic current to remove deep urethral sensitiveness, if this is present, or by recto-perineal faradic sedation, whichever will accomplish the purpose best after trial in the individual case. Some men object more than others to the insertion of an electrode into the urethra.

Galvanic.—Moisten a layer of absorbent cotton covered

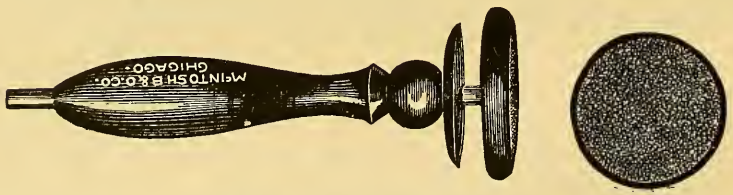


Fig. 248. Carbon disk electrode.

over a carbon hand electrode in the invariable bicarbonate of soda solution employed with all galvanic currents, connect it with the positive pole and apply it to a convenient situation upon either side of the lower abdomen.

Insert into the urethra a steel sound as large as the canal will take without undue dilatation, have it connected with the negative pole of the galvanic battery, and after it is in contact with the entire mucous membrane increase the constant galvanic current from zero to 2, 3 or 4 mil. according to the sensitiveness of the part.

The duration of the application must be governed by the sensitiveness. If the patient complains reduce the current to zero and withdraw the sound, whether this occurs after a fraction of a minute or after two or three minutes. Tolerance will rapidly develop after the first or second application as the congested irritable state of the mucous membrane benefits by the alkaline and electrolytic action of the current.

Repeat three times a week at first until sensitiveness is abated sufficiently to permit a few daily applications.

If the sensitiveness is not general but circumscribed, or becomes so in the course of treatment, substitute an olive electrode for the sound, and when it is in contact with the sen-

Fig. 249. Set of olive electrodes.

Handle for same.

sitive spot rapidly increase the galvanic current from zero up to full tolerance, about 4 or 6 mil., and maintain only for about

one minute. Repeat this application not oftener than once in four or six days.

Faradic Sedation.—Place the patient in the dorsal position upon the operating table. Connect a rectal electrode with the negative pole of the high-tension induction coil apparatus and insert it against the prostatic portion of the urethra. Press a

Fig. 250. Rectal electrode, bare metal.

sponge-covered hand electrode moistened with hot water firmly upon the anterior perineum with the scrotum held out of the

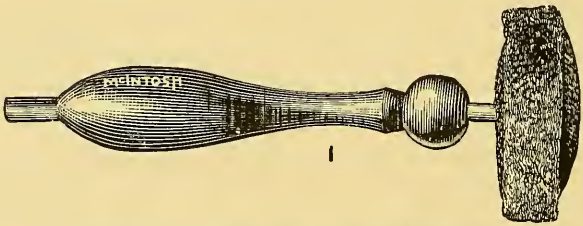


Fig. 251. Sponge-covered hand electrode.

way by the patient. Connect this with the positive pole. Switch into circuit the 1,000 yard No. 36 coil, rapid vibrator and four cells, regulate the current strength through the secondary rheostat from zero up to agreeable tolerance. It should be sufficient to produce and maintain a strong, comforting grasp upon the tissues, and as sedation increases and the effect dies away the dose should be accordingly strengthened a little. After effecting complete sedation, or about fifteen minutes, reduce the current to zero gradually.

As soon as sedative applications may give place to tonic measures the nutritional and tonic properties of galvanic and static currents may be employed. Galvanic currents combine two methods for local and general effects.

1. *Central Galvanization.*—This is the chief and practically

the only method of obtaining general constitutional effects by means of the galvanic current. The technique is described in full elsewhere. After completing the usual routine place the positive electrode at the back of the neck and the negative at the coccyx. Regulate the dosage to about 15 mil., pass it downward for a moment and then make gradual reversals of polarity two or three times at intervals of a minute each, and close the sitting with the descending current.

2. *Local Stimulation* with the galvanic battery is as follows:

Seat the patient upon the forward edge of a high stool. Fill a suitable bowl nearly full with a saturated solution of rock

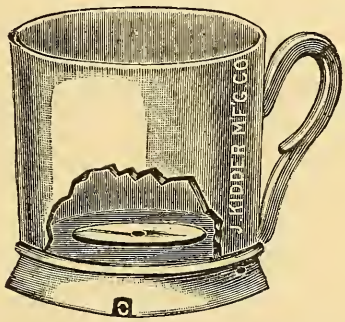


Fig. 252. Water-bath electrode.

salt in tepid water. Have the patient support this water-bath electrode with the parts entirely immersed during the sitting. Connect it with the negative pole. Moisten a sponge-covered hand electrode with a one or two per cent. solution of soda

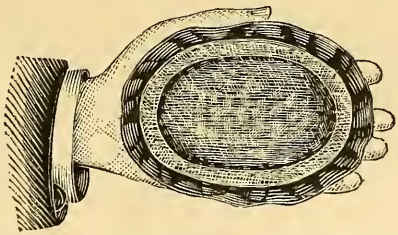


Fig. 253. Sponge-covered flat electrode.

bicarbonate, connect it with the positive pole of the galvanic battery and promenade it across the lumbar region with a current strength sufficient to produce warmth and comfort in the parts. After about ten minutes reduce the current to zero, switch the automatic interrupter into circuit and again increase the dose until comfortable pulsations are felt. Avoid increasing the current strength so greatly as to produce any discomfort.

Repeat daily or every second day.

Static.—Seat the patient upon the static platform connected with the positive pole. Study the methods described in the chapter upon producing *special therapeutic effects* and proceed to administer a thorough nutritional treatment with *counter-irritation* over the entire spine.

At the close of each sitting apply a few positive sparks to the perineum by means of the spark electrode protected by a shield of surrounding glass.

These three methods may be employed in alternation at different sittings, or the one which gives the best results in a given case may be continued. Cases differ so that no routine can apply to all alike. Appropriate tonic medication, the use of sedative hot sitz baths at night, hot applications to the perineum, tonic douches of cold water, salt water bathing, outdoor exercise, and all other rational aids to treatment must be directed as usual, but without doubt the value of the action of electric currents places them in the front rank of beneficial remedies.

Psychical Impotence.—Scarcely any case of this condition can be imagined in which neurasthenia is not present. The very existence of the disability points to a nervous derangement as the cause. General tonic and nutritional static electricity is indicated if ordinary medical prescribing does not prove sufficient.

The treatment should aim at the neurasthenia rather than at local stimulation, and the whole subject of the treatment of functional nervous disturbances must be taken into account

according to the individual case. The reader is referred to the chapter upon *neurasthenia.*

Paralytic Atonic Impotence.—In this stage the parts are sunken and anæsthetic, erections no longer occur and desire is lost. It is not worth while to treat this stage locally unless there are other indications demanding some special relief, as the genital functions have gone into permanent bankruptcy.

Atrophy of the Testicles from Over-activity.—In this condition the penis is also usually shrunken and hard and the entire organs may all be treated together.

Immerse them deeply in the water-bath electrode connected

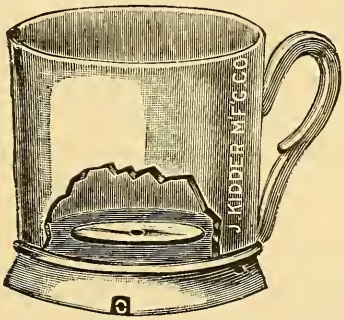


Fig. 254. Water-bath electrode.

with the negative pole of the galvanic battery. Fill this with the semi-saturated solution of rock salt in warm water.

Connect a sponge-covered hand electrode with the positive

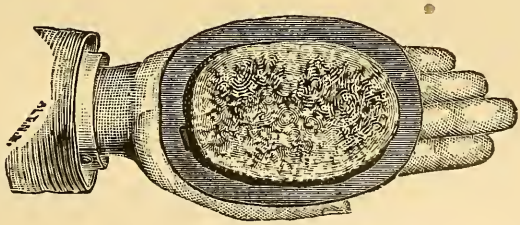


Fig. 255. Sponge-covered flat electrode.

pole and apply it over the great nerve centres of the lumbar spine. Gradually increase the constant galvanic current through the rheostat from zero up to about 15 mil. and maintain this dosage for about ten minutes. Then reduce the current to zero, switch the interrupter into circuit and again increase the current strength until mild stimulating pulsations are felt through the parts. In three or four minutes reduce the current to zero and close the sitting.

A perusal of the chapter on the physiological action of the galvanic current will sufficiently explain its value in all these conditions. The sedative tonic action upon the nerve centres near the positive pole and the increased blood supply and nutritional action upon nerve cells and fibres at the negative pole make this current valuable.

A variation and alternate treatment consists of connecting the same electrodes with the induction coil apparatus.

A second variation consists in joining the two currents and making the treatment consist of a galvano-faradic stimulation.

Repeat daily or every second day as long as is necessary to produce results.

The local application of static spark to the perineum and to the spine should be an important part of any extended course of treatment in these cases.

Atrophy of Testicles with Spermatorrhœa from Partial or Complete Paralysis of the Sphincter Muscles of the Vesiculæ Seminales.—Ten years ago I gave it as my opinion that partial or complete paralysis of the sphincter muscles of the vesiculæ seminales was the true pathology, and that electricity was the sheet-anchor in treatment. I have never had cause to change my mind. I have never had a case which I have not been able to arrest with electricity alone. (*St. Clair.*)

Moisten a felt or sponge-covered, flat electrode, about 5 × 8, in one or two per cent. hot-water solution of bicarbonate of soda, connect it with the positive pole of the galvanic bat-

Fig. 256. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

tery and apply it with firm contact over the region of the bladder.

Employ a flattened olive or prostatic electrode of bare metal

Fig. 257. Electrode insulated on under half.

insulated by hard rubber upon one side, connect it with the negative pole, lubricate it with glycerine and insert it into the rectum so that the metallic portion will be in contact with the affected parts.

Gradually increase the constant galvanic current through the rheostat from zero until it is just strong enough to create a general warmth at the negative contact. Continue the application for from five to ten minutes and repeat twice a week. Allow from two to three months for a course of treatment.

Sexual Hypochondriasis.—In these pitiful subjects there is usually a derangement of the entire sympathetic nervous system. Whatever will restore tonicity to the general functions of the body will improve the mental state. These cases need better digestion, better nutrition, better circulation, better red blood corpuscles, better sleep, and, having these, they will regain a better frame of mind.

They industriously seek relief, but are too often put aside with an utterly inadequate prescription, because medicine cannot miraculously minister to the mind diseased or prescribe an antidote that will act instantly. Hygienic advice and remedies directed to functional regulation and nutrition are all needed

by these patients, particularly attention to the functions of the liver. After these the best possible curative remedy is electricity.

Galvanic, faradic and static currents by general methods are all useful. The aim is nutritional stimulation, and central galvanization and general faradization are the two available resources for those who have only a partial complement of apparatus, while the static machine is the sheet-anchor of treatment with all who are fortunate enough to own one.

Start the hepatic and digestive forces into action, correct the anæmia, restore confidence, and static electricity and nature will generally do the rest.

Granted that two, three or even six months of persistent treatment is required to restore the cheerful mental state and sound body, this tax upon time and patience is small compared with the life before these desponding young men.

If a source of the trouble is a congested prostate, efficient relief of this condition may be obtained by faradic sedation after proper attention to regular action of the bowels. Insert a rectal electrode and connect it to the positive pole of the high-tension induction coil apparatus. Place a negative

Fig. 258. Rectal electrode, bare metal.

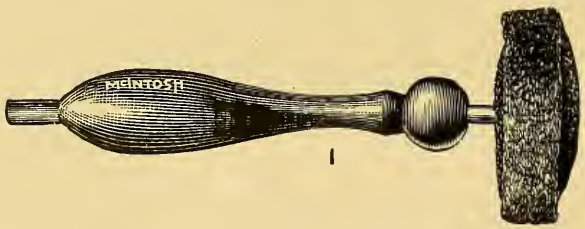


Fig. 259. Sponge-covered hand electrode.

electrode upon the perineum and conduct the treatment according to the directions given for irritable atonic impotence. It is not a difficult matter to decide what particular forms of local treatment will be useful in a given case, and if persistent constitutional treatment is actively aided by nutritional tonic static administrations as described in the chapter on *special therapeutic effects* the results will usually be satisfactory. Owing to the superior therapeutic efficiency of general static electrification over the general electrification methods of employing galvanic and faradic currents, and the additional fact that no disrobing is required for static treatment, the latter is decidedly the most practical in office work.

CHAPTER XXXIII.

TREATMENT OF GENITO-URINARY CONDITIONS.

Enuresis. Treatment of incontinence of urine in adults. Urethritis and gonorrhœa. Gleet. Epididymitis, acute and subacute. Pains of varicocele. Orchitis. Tubercular orchitis. Treatment of hydrocele. Acute cystitis. Chronic cystitis.

Enuresis.—In all ordinary cases, and especially in children, electricity is appropriately reserved as a last resort and simple medication should be employed first.

The only current which can be applied externally without exposure of the person is static, and this is available for patients of any age or sex and regardless of the cause of the disease. The prognosis will vary with the cause, but the principle of treatment is the same.

Seat the patient upon the static platform connected with the negative pole. Ground the positive pole, and after simple electrification to acquaint the patient with the apparatus, ground the brass ball electrode and apply mild sparks to the cervical and lumbar spines and to the lower abdomen. Next change to the insulated spark electrode and apply a few sparks

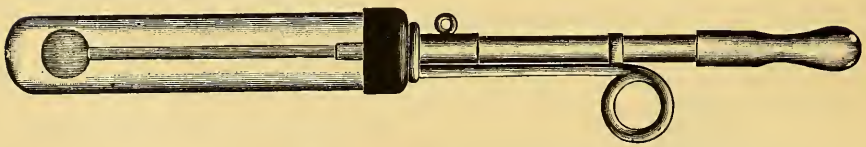


Fig. 260. Insulated spark electrode.

as nearly upon the perineum as it is possible to do through the clothing.

If the patient is in a nervous condition add such other sedative methods as may be indicated. In the case of children

this treatment must be cautiously given, not because it can do any harm, but because only a tactful operator can give sparks to a child without exciting it.

In the case of adults, and especially when the condition accompanies disease of the spinal cord, the treatment may be much more vigorous and may be supplemented by the galvanic current.

Moisten a felt-covered electrode, about 4×6, in a hot-water

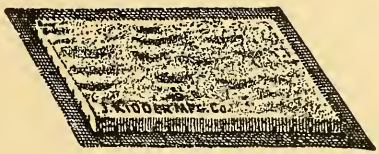


Fig. 261. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

solution of bicarbonate of soda, connect it with the positive pole and apply it to the back of the neck. Place a similar electrode over the bladder and connect it with the negative pole. Gradually increase the constant galvanic current from zero up to 15, 20 or 25 mil., according to tolerance. In about five minutes reduce to zero and close the sitting. Repeat regularly every day, or three times a week, until the improvement ceases.

Faradic.—The faradic current may be employed in several ways.

Moisten a sponge-covered, flat electrode, connect it with

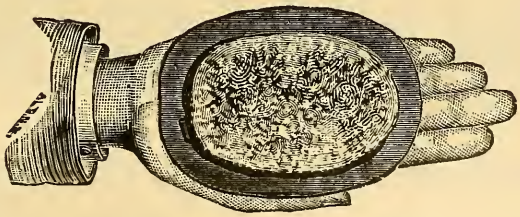


Fig. 262. Sponge-covered flat electrode.

the positive pole of the high-tension induction coil apparatus and place it over the bladder. Connect a sponge-covered hand electrode with the negative pole and place it upon the sacrum

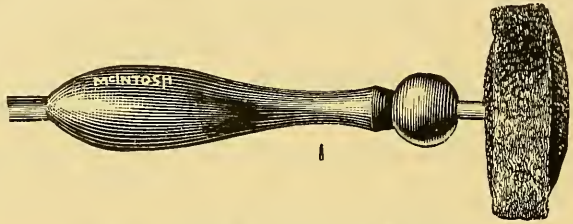


Fig. 263. Sponge-covered hand electrode.

if a girl, and upon the perineum if a boy. Switch into circuit the rapid vibrator, about three cells and the combined No. 21 and 32 wire coils. Gradually increase the current strength until it produces a strong grasp upon the tissues. Maintain the current until a sedative-tonic effect is produced (about eight or ten minutes), and reduce gradually to zero.

The more effective faradic method is applicable to all cases in theory but may be difficult to carry out with children.

Moisten a felt or sponge covered, flat electrode, about 4×6,

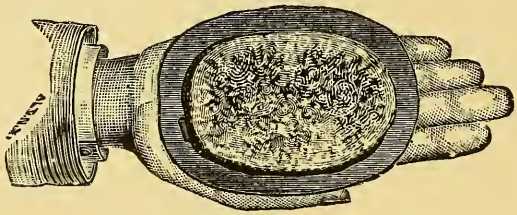


Fig. 264. Sponge-covered flat electrode.

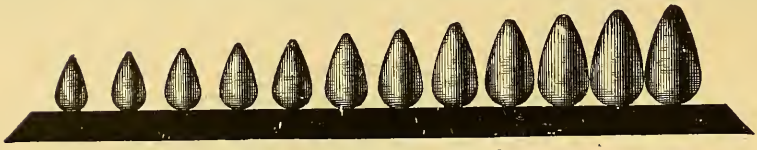
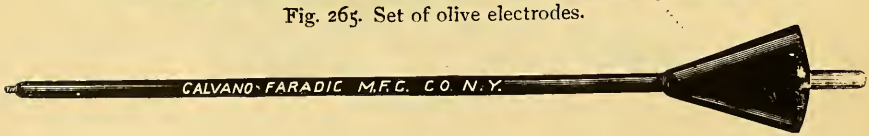


Fig. 265. Set of olive electrodes.



Handle for same.

connect it with the positive-pole of the induction coil apparatus and place it over the bladder. Select an olive-tipped, insulated electrode of a size which can be inserted into the urethra to the neck of the bladder. In the case of children an electrode may be improvised of a small wire (smoothly polished) if no electrode small enough for the purpose is at hand, but it is better to use some other method if there is difficulty in introducing a tip into the urethra in any individual case.

With the electrodes in position switch into circuit the very slow vibrator (about seventy interruptions per minute), three cells and the combined 21 and 32 wire coils. Beginning at zero gradually increase the current strength until forcible but perfectly comfortable contractions are produced. Treat the muscles upon the same principle as paralysis. Begin at first with a few mild contractions and increase the number and energy at subsequent sittings. Repeat daily at first and later three times a week until improvement is sufficient.

The Electrical Treatment of Incontinence of Urine in Adults.—Among all the treatments for the cure of this affection, electricity is at times the most efficacious. Some authors mention good results from the use of galvanism or faradism in cases of *nocturnal* incontinence in infants and young children, but they pass over in silence another form, which is due to lack of power in those parts which should hold back the urine. It is nevertheless a common enough affection judging from the number of cases I have to treat in private and hospital practice. It seems to affect women oftener than men. It lacks the complexity of the infantile form, and it is the result simply of atony of the vesical sphincter, which is found in all degrees from simple weakness to complete paralysis.

My treatment for this affection is of the simplest character.

CASE I. Woman, age sixty-five, passes her water when walking, laughing or coughing. On awaking in the morning she finds her bed wet. The disease has lasted for ten years, but there have been short periods of remission now and then. General health good. All known methods of treatment have been tried in vain.

Treatment. A curved electrode with a bulbous point was placed in contact with the neck of the bladder, while a flat electrode upon the lower abdominal region completed the current. Seventy faradic contractions were made. The next

Fig. 266. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

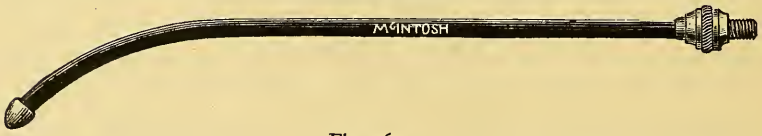


Fig. 267.

day there was a slight improvement, and eighty contractions were given. These two treatments sufficed to arrest the nocturnal incontinence entirely. After two more treatments the patient was so far improved that there was no escape of urine, during walking, laughing or coughing; but some came away when violent efforts of any kind were made. She considered herself entirely cured. I applied one hundred more contractions. She did not return to the hospital any more; but five months after I saw her and she had no return of the trouble.

CASE II. Female, age twenty-seven. On May 9, 1890, she had undergone the operation of curetting the uterus. After the operation she was fifteen days without being able to urinate. The neck of the bladder was then cauterized with nitrate of silver, and after this she was unable to hold her urine night or day. The urine was turbid, and cystitis was evidently present. She suffered from sharp abdominal pains on both sides. For about a month her general condition, sleep and appetite have been poor.

April 24, 1891. The treatment was commenced by giving sixty faradic contractions, the poles being placed the same as in the preceding case.

May 1. The patient can now pass her water herself to a certain extent without pain. Incontinence still present. Eighty faradic contractions were given.

May 8. She was able to wear a corset for the first time since

the operation. The involuntary flow is a good deal lessened. She can now pass her water freely and without pain. Eighty contractions.

May 23. The urine is clear. Feeling of pain is gone. The involuntary loss is almost imperceptible. Eighty contractions repeated.

May 26. There is no longer any trace of incontinence, the urination is absolutely normal.

July 3. The cure still remains perfect.

These observations have been taken day by day from the patients themselves and may be absolutely relied upon. (*Jour. of Electro-Therapeutics.*)

Urethritis and Gonorrhœa.—With the patient in the dorsal position on the operating table (after washing out the canal) place in any convenient situation on the lower abdomen a felt-covered, flat electrode, about 4 × 4, moistened in the hot-

Fig. 268. Felt or sponge covered flat electrode, assorted sizes.

water solution of bicarbonate of soda and connected with the negative pole of the galvanic battery. Retain it firmly in contact with the tissues by the weight of a small shot-bag or the patient's hands.

Select a urethral sound electrode of zinc, as large as will comfortably fill out the canal, and prepare it for zinc amalgam electrolysis. (For directions see Index.)

Connect this electrode with the positive pole and insert it the full length of the canal. Gradually increase the constant galvanic current from zero up to the full tolerance of the

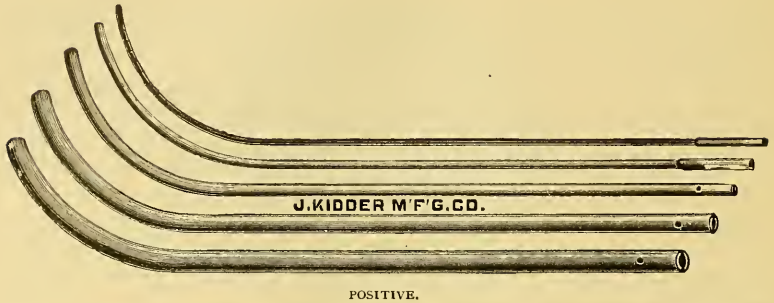


Fig. 269. Five electrodes: insulated with soft rubber tubing to expose any desired surface.

urethra. In the very acute stage only a mild current can be employed. Stronger currents will be tolerated later, but sufficient amperage must be used to produce the effect of germicidal zinc and mercury action within the tissues.

Copper electrodes have been used for this purpose during the past three or four years, but copper sets up great irritation and adheres to the tissues unless it is kept in gentle motion. The mercury-coated zinc electrode does not produce irritation and does not adhere.

Prescribe as usual in these cases and repeat the electrical application twice a week.

If the current strength employed is sufficient to act thoroughly it should produce curative results in a very short time. Theoretically it is the most certain and speedy means of cure known, and quick results from both copper and zinc electrolysis have also been reported by a number of observers, while others find copper very disappointing.

The following case reported by Webster in the *Massachusetts Medical Journal* suggests the possibilities of employing the sedative anti-congestive and vaso-constrictor properties of rapidly interrupted high-tension induction coil currents for the relief of certain acute symptoms arising from œdema of the parts.

Theoretically the sedative effect should be admirable with the improved current from high efficiency apparatus, but I

have never made any practical trial in a case of this kind. Of course it is not intended to imply that the induction coil current has any curative or germicidal action upon Gonorrhœa *per se*.

Several years ago a carpenter, possessing the most active case of gonorrhœa I ever saw, called on me for treatment. The penis was swollen enormously, priapism nearly constant, and the aching was almost unbearable. As the patient was fulfilling a contract and the time was almost up, he could not be incapacitated from work, and he demanded prompt relief. I introduced an urethral electrode one inch into the urethra and connected it with the anode, and the cathode (a sponge) was placed in his hand. The faradic current was turned on and in a few minutes the pain was lessened, and after twenty minutes the relief was so decided that he departed for his work. He returned for treatment the following day, and the former treatment was repeated and small and frequent doses of aconite and jaborandi were also given. The faradism was repeated every day for ten days. The cure was complete and left no sequel.

The same application could be made with the penis simply immersed in the cup electrode.

Gleet.—For the treatment of chronic urethritis without stricture the negative alterative action of the galvanic current has long been employed upon the same principle as in the treatment of any ulcerating surface.

Moisten a felt-covered, flat electrode, about the size of the

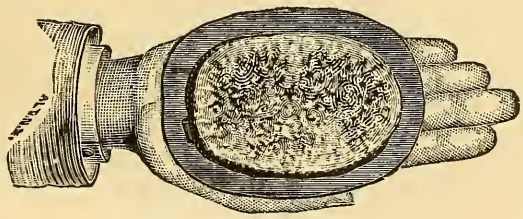


Fig. 270. Sponge-covered flat electrode.

palm of the hand, in the usual hot-water solution of bicarbonate of soda, connect it with the positive pole of the galvanic battery and place it upon the lower abdomen in any conven-

ient place. Retain it in firm contact with the tissues either by the weight of a small shot-bag or the pressure of the patient's hands.

Having first irrigated the canal, select an olive-tipped electrode about as large as the urethra, connect it with the nega-

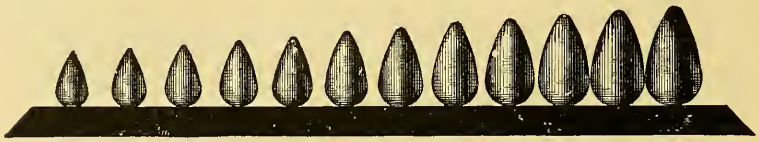


Fig. 271. Set of olive electrodes.

Handle for same.

tive pole, lubricate it with glycerine and insert it into the canal. By moving it along the surface discover if possible the area of tenderness which locates the site of unhealthy granulation and discharge. Keep the negative electrode in contact with this place, gradually increase the constant galvanic current through the rheostat from zero up to about 5 mil. The first sitting should be short. Reduce the current to zero in one or two minutes.

In about three days repeat again with a little longer sitting. After several treatments the dosage may be increased slightly, the duration of the sittings may gradually extend to ten minutes, and application may be made as often as three times a week, but these matters depend upon the degree of irritation when first seen, the rapidity of improvement and the tolerance of the tissues. Every treatment must be regulated with judgment.

At least five to ten applications should be made after the discharge appears to have entirely ceased, for the chronic nature of gleet and its disposition to return renders it neces-

sary to persist until the mucous membrane is as nearly healthy as possible.

Metallic electrolysis is also employed.

Epididymitis, Acute and Subacute.—Fill a small bowl nearly full of warm water and add about half a dram of bicarbonate of soda. Drop to the bottom of the bowl the tip of cord attached to the positive galvanic pole. Immerse the entire part as deeply as possible in this water-bath electrode.

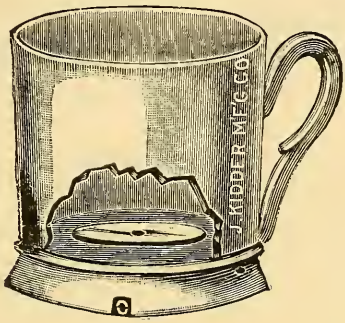


Fig. 272. Water-bath electrode.

Moisten any ordinary hand electrode covered with absorbent cotton, felt or sponge in the same solution of bicarbonate of soda and press it steadily upon the inguinal region of either side. Connect this with the negative pole.

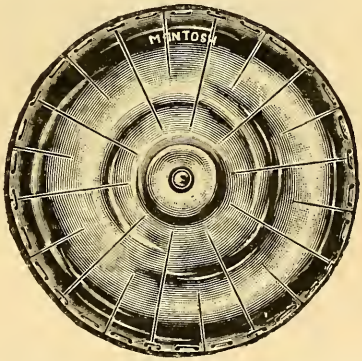


Fig. 273. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Very slowly and gently increase the constant galvanic current through the rheostat from zero up to 4 mil. In about five minutes reduce to zero. Repeat daily after withdrawing the electrode, dry and dust the part with a cooling powder. Adjust a comfortable suspensory. No detention from business or rest in bed will usually be required. The patient can walk about but should of course avoid exertion. Relief from pain and other symptoms is rapid, and swelling disappears more quickly than under routine methods.

As improvement advances the dose may be increased gradually to about 7 mil. and the duration of the sitting may be ten minutes. Repeat daily for two weeks or until sufficiently relieved.

In chronic cases but little can be expected from this method, although if the patient requires an operation and refuses it any conservative measures may be tried without promising results. If the mass is old, hard and without inflammatory tenderness the negative electrode should be applied locally and the current strength carried up to the point of tolerance.

Pains of Varicocele.—Immerse the scrotum in the cup electrode filled with a solution of bicarbonate of soda, and connect it with the positive galvanic pole. Moisten any felt or

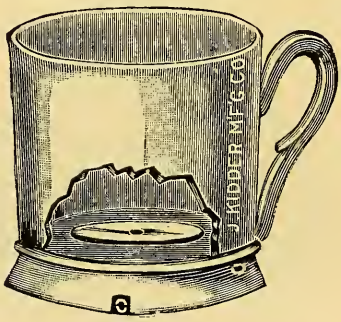
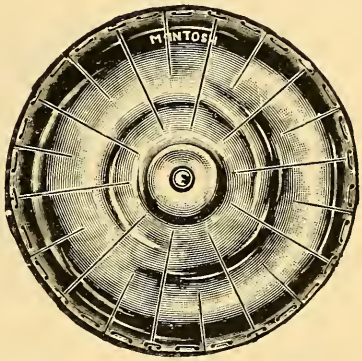


Fig. 274. Water-bath electrode.

sponge covered electrode, about 3×4, connect it with the negative pole and place it upon the inguinal region. Gradually



Figs. 275–276. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

increase the constant galvanic current through the rheostat from zero up to 5 mil., and in a few moments as sedation is affected increase to 8 or 10 mil. if this dosage is comfortably borne. Maintain the action of the current for ten or even fifteen minutes until pain is relieved. Repeat p. r. n.

The above method is a simple palliative preparatory to operation for a radical cure in cases in which the patient seeks relief from pain before anything else is done.

"The toning up of dilated blood-vessels alone gives great relief, as I have many times found in varicose veins of the testicle where a single application of 5 or 10 mil. for ten minutes or a quarter of an hour will completely relieve the most excruciating pain of varicocele, the relief lasting from many hours to many days, or in a few cases even altogether." (*Smith.*)

Orchitis, Simple Acute and Subacute.—Ordinary forms of treatment can be supplemented by the sedative and pain-relieving properties of the galvanic current.

Fill a suitable bowl nearly full of warm water and dissolve in it half a teaspoonful of bicarbonate of soda. Sink the tip of the positive conducting cord into this solution and immerse the entire organ as deeply as possible in this water-bath electrode.

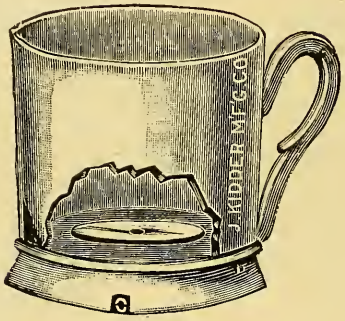
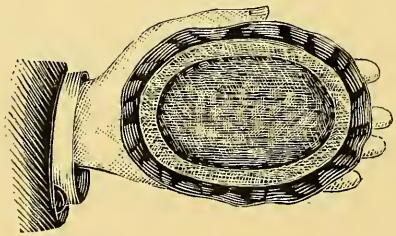


Fig. 277. Water-bath electrode.

Moisten in the same solution of bicarbonate of soda a felt or sponge covered electrode of medium size, connect it with the



POSITIVE.

Fig. 278. Sponge-covered flat electrode.

negative pole of the galvanic battery and apply it firmly upon any convenient point of the lower abdomen of either side.

Gradually increase the constant galvanic current through the rheostat from zero up to about 5 mil. The current should be just strong enough to produce a soothing sensation with gradual relief to the pain, and when this point in the regulation of the dose is reached all increase should be stopped and the current maintained steadily for about five minutes. Reduce the current gradually to zero before withdrawing the electrode. Then dust the parts with a sedative powder and repeat the same application daily until relieved.

Other local and internal measures may be prescribed as usual, including the indispensable support.

If the case is more chronic when first seen the dosage may be increased, and if inflammatory symptoms have entirely subsided and the question is mainly one of stimulating absorption of inflammatory exudation, the water-bath electrode should be made negative and the current carried up to the point of tolerance (often 15, 20 or more mil.).

After preliminary treatment of a chronic case in which there is no liability of aggravation the interrupter should be switched into circuit after reducing the constant current to zero. Regulate the rate to about 125 periods per minute and increase the current strength until pulsation is perceptible through the parts. Maintain this action for from three to five minutes and close the sitting. After a neglected case has become very chronic and indurated the amount of treatment required may cover several months and the ultimate result may be only symptomatic relief, with partial softening and reduction of the size of the affected parts. I have seen, however, a case of this kind treated in the above way improve in thirty days so that the patient was more comfortable, without requiring a suspensory, than he had been for years with a suspensory.

Tubercular Orchitis.—I have two cases that have been greatly benefited. In both cases the static cage has been used in conjunction with local galvanism. One of the gentlemen lost the right testicle on account of tubercular ulceration. After the right testicle had been removed the left one was invaded and he was sent to me to see if I could possibly do anything for the indurated mass of epididymis that took the place of the left testicle. This mass at its dependent portion was deeply ulcerated. Such an ulceration caused the loss of the right testicle.

Fifty milliamperes of constant galvanic current through the indurated mass daily and occasional use of the soluble copper positive electrode into the ulceration, followed by ten minutes in the static cage, constituted the treatment.

The induration has nearly disappeared, the ulceration has

completely healed, the patient has gained four pounds in weight and is in every way improving. He now enjoys walking and bicycle riding. The former exercise, when he came to me, was both fatiguing and painful, and the latter was out of the question.

The other case had no ulcerations nor had he been operated on, but had had several attacks of orchitis. On the left side the testicle was chronically enlarged and indurated. The right testicle was small and flabby. The patient was pale and thin, with hectic flush, weak throat and weak voice. I could discover no deposit in the lungs.

He has been under treatment one year by galvanism and in the static cage, receiving treatment three times a week. He has gained in flesh and strength, the testicles are nearly of one size and consistency, and he has no longer the appearance of one in the early stage of consumption. (*Bishop.*)

Hydrocele.—Moisten a felt-covered, flat electrode, about 7 × 10, in the usual hot-water solution of bicarbonate of soda. Place the patient in the dorsal position on the operating table. Place the felt electrode upon the abdomen and connect it with the positive galvanic pole. Retain it firmly in contact with the tissues by the weight of the patient's hands or a suitable shot-bag.

Fig. 279. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Cleanse the skin of the scrotum with any antiseptic solution. Select a sharp and large puncture needle (steel) insulated within half an inch of its point, connect it with the negative pole and sterilize it. Next insert it into the centre of the

tumor until the skin is traversed by the insulated part of the needle. Care should be taken to avoid the testicle.

Fig. 280.

Very slowly increase the constant galvanic current through the rheostat from zero up to 15 or 20 mil. Pause at the appearance of any burning sensation until it passes away, but by successive steps of advance increase the current to about 40 mil. Maintain it at this point for about five minutes and gradually reduce to zero.

Next withdraw the electrodes, bandage the tumor so that gentle pressure will hasten absorption, adjust a suspensory support and have the patient remain in bed two or three days.

The number of treatments required vary from a single one to an average of about four. They may be made at intervals of a week. No anæsthetic is required. With modified dosage the same treatment is applicable to cases occurring in children.

The treatment of this disease offers one of the most favorable conditions for the employment of electricity, and it is more than probable that when knowledge becomes more diffused all other and more uncertain methods will be given up for this one. The treatment by negative galvano puncture is a most simple, satisfactory and, when properly performed, harmless form of treatment, and is therefore recommended as the best that we know of to-day simply because it has stood the test of experience. (*Robinson.*)

Acute Cystitis.—Few physicians employ electricity in acute cystitis. Nevertheless, as an adjunct to other measures successful relief of pain and tenesmus may be obtained by the employment of a galvanic current. The method described for this purpose is as follows:

Select two similar felt-covered, flat electrodes, about 6 × 9, moisten them in the usual hot-water solution of soda-bicarbonate and connect them with the opposite poles of the galvanic battery. Place the negative under the sacrum and the

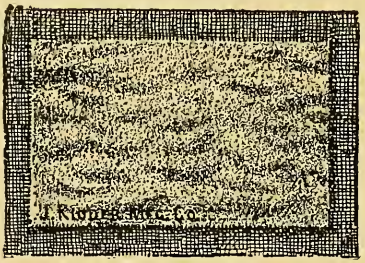


Fig. 281. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

positive over the bladder. Gradually increase the constant galvanic current from zero up to 10, 15 or more mil., stopping at the point which produces the greatest comfort and relief to the patient. Continue the application until the utmost relief is obtained, from ten to twenty minutes, and repeat night and morning, or as often as the pain returns, until convalescence is established.

If the patient is a male the sitting should be ended by removing the supra-pubic electrode after it affords relief and applying a carbon electrode covered with absorbent cotton to

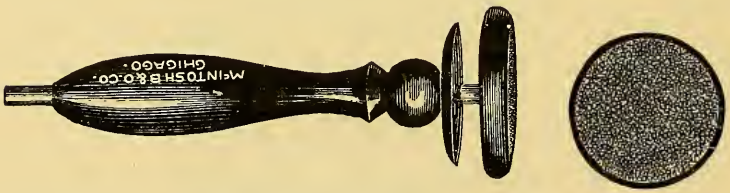


Fig. 282. Carbon disk electrode.

the perineum. This is connected with the positive pole and the current again passed as before—between the perineum and sacrum.

In the case of a female substitute a carbon ball electrode protected with absorbent cotton moistened in the bicarbonate of soda solution for the sacral electrode. Insert this in the

Fig. 283. Carbon ball electrode.

vagina after the first part of the *séance* and pass the current between the vaginal and pubic electrodes.

It is surprising how quickly pain has vanished and tenesmus lessened under this treatment in these cases. (*Hutchinson.*)

Chronic Cystitis.—Whether this is associated with an incurable disease of the cord atony and partial paralysis or is simply a chronic inflammation affects the prognosis rather than the method of electrical treatment. In an incurable case some improvement may be expected from persistent treatment. In other cases with a favorable prognosis a couple of months suffices for treatment. Prescribe medical measures as usual.

Moisten two felt-covered, flat electrodes, about 6 × 9, in the

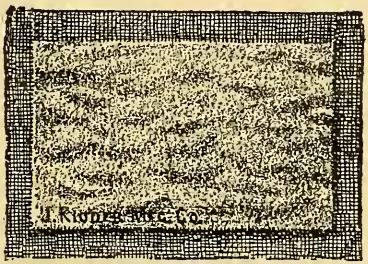


Fig. 284. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

usual hot-water solution of bicarbonate of soda and connect them by a bifurcated cord to the positive pole of the galvanic battery. Place one beneath the sacrum and the other over the region of the bladder.

Prepare in a suitable irrigating jar an alkaline and antiseptic solution of any formula suitable for the irrigation of the blad-

der in the case at hand. Connect the douche electrode with the end of the rubber tube and with the negative pole of the galvanic battery.

Lubricate and insert the electrode into the bladder. Start the flow of the solution. Gradually increase the constant galvanic current from zero up to tolerance. Continue the administration for from 10 to 20 minutes according to the comfort of the patient and the effect. When pain is severe stop the current at once. When longer sittings can be given with increasing comfort the application should be continued for thirty minutes. Repeat twice or thrice a week.

Owing to the construction of the electrode the current cannot come into harmful contact with the mucous membrane and the method is perfectly safe. It is especially adapted to obstinate and gonorrhœal conditions of either male or female.

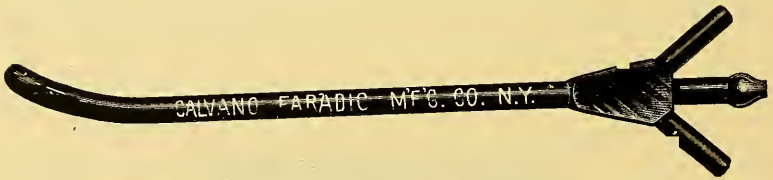


Fig. 285. Vesical electrode, for hydro-electric applications to female bladder. Useful in atony, dilatation, chronic cystitis, etc.

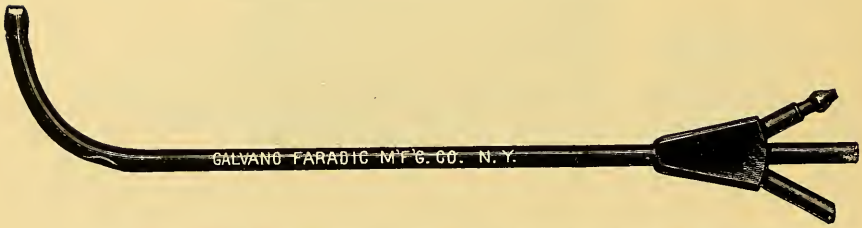


Fig. 286. Vesical electrode for hydro-electric applications to male bladder.

CHAPTER XXXIV.

TREATMENT OF URETHRAL STRICTURE.

Directions for treatment by electrolysis. Urethral spasm and hyperæsthesia. Discussion of urethral stricture and electrical treatment. Linear electrolysis.

A CASE of stricture is not ready to treat by electrolysis until inflammation is subdued. Preparatory treatment is the first essential step, but whether much or little is required depends on the state of the patient.

When ready to begin the local application of the galvanic current in a suitable case wash out the urethra with a bland solution of boracic acid and place the patient for convenince in the dorsal position on the operating table with a positive felt or sponge covered electrode, about 3×4, laid on the opposite inguinal region. The hand of the patient can easily retain it in place with proper contact. Moisten it thoroughly in the usual hot-water solution of bicarbonate of soda, a teaspoonful to the int of water.

Fig. 287. Fine felt or sponge covered flat electrode—assorted sizes with soft rubber insulating backs.

Having determined during preliminary treatment the amount of stenosis of the canal and situation of strictures (if more than one exist) select one of the set of electrodes a size larger than will pass the point of stricture without force. Connect this olive-tipped electrode with the negative pole of the galvanic battery. Do not smear the end of it with any non-conducting lubricant. Dip it in glycerine after sterilizing the electrode.

Fig. 288. Straight urethral electrode. (*Dr. C. W. Krauss.*)

Fig. 289. Dr. D. D. Richardson's improved electrodes for treatment of urethral stricture—assorted sizes. In these instruments the hard rubber insulation at the distal end is sloped down to about four sizes smaller than the metalic bulb, so that when the stricture is engaged by the active part of the electrodes it is *on the stretch*, and having perfect contact with the metal presents the best conditions for electrolysis.

Use a straight handle for the pendulous urethra or a curved handle for the membranus or prostatic portion. Pass the electrode down to the stricture, and when it is brought to stop maintain it steadily in position without much more force than is required to keep it down to close contact. Strictures require patience and not force.

Gradually increase the constant galvanic current through the rheostat from zero up to the point of producing merely a sensation of warmth and slight tingling at the internal electrode.

If the stricture requires the smallest size olive the meter may register only two or three mil. at the first sitting. If the tip is larger the amperage will increase with the area of contact without increasing the density of the actual dose. From three to seven mil. includes the range of dosage required throughout the conduct of an ordinary case.

When the proper dosage is regulated allow it to pass evenly for several minutes. What next occurs will depend upon whether the morbid material attacked is the ordinary plastic deposit of inflammation, or dense resilient scar tissue from previous traumatism.

In the former case the electrode will shortly glide or appear to be sucked into and through the constricted canal ; then slowly withdraw the electrode backward through the stricture without changing the current, and when it has accomplished this reduce the current gradually to zero, remove the electrodes and close the sitting.

If the cicatrix is dense rubber-like fibrous tissue from previous cutting or caustics or *any other cause* the electrode will not go though the stricture in the usual five, eight or ten minutes, but will require greater patience, If the action of the current causes no irritation it may be maintained until the electrode gets through, even if from fifteen to thirty minutes is required at the first sitting. Future sittings will require less if the case is suitable for electrolysis.

If patience and careful adjustment of a proper softening and relaxing dose (not a cauterizing and burning dose, see chapter on Electro-physiology) does not pass the stricture, but after fifteen minutes develops any uncomfortable irritation, reduce the current carefully to zero, withdraw the electrode and wait until the next sitting and use a smaller electrode. Repeat exactly the same process at intervals of from six to ten days, allowing the results of each application to mature by the processes of nature before the next is made.

When more than a single stricture exists the electrode may be carried through the second at the same sitting before the current is reduced if it is accomplished without difficulty or irritation ; otherwise treat one stricture at a time. In fact do what can be done well and no more.

No local anæsthetic is required. If there is too much irritation to permit the use of the electrode without local anæsthesia there is *too much irritation to commence this part of the*

treatment. There is no tax upon the strength of the patient and no pain which results from the current. The patient may be treated in a standing position if the operator prefers. Both before and after the commencement of the electrolytic method the general health of the patient should be looked after and micturition kept bland by a suitable prescription if it is irritating.

The total duration of treatment varies as obviously as the degrees of stricture vary. From three to eight treatments will improve simple cases. Complicated cases may expect to require four or six months' treatment. If the case is not readily amenable to electrolytic softening the lack of action upon the tissues during the first few sittings becomes apparent and the physician is not obliged to continue the method unless he chooses, but if the patient agrees there is no other objection to longer treatment.

The consideration of any other method will not be affected because a trial of electricty has first been made.

If at any period the urethra is very sensitive and bleeds when attempting to pass a sound or electrode the local application of the galvanic current is contra-indicated until this state is removed.

After any treatment by electrolysis no sound is to be passed nor any attempt at further dilatation made at the same sitting. Let the urethra alone until the next *séance.*

Dense fibrous bands do not offer a good field for this method, and we observe that dense fibrous cicatricial tissue upon any other part of the body is also very difficult to soften by electrolysis. It can be done if conditions permit a high current, but it takes a long time with a small current and is not worth while.

In considering some points in the treatment of stricture, and especially the causes of many failures, King remarks that the percentage of failures has been greatest in strictures located within a space in the immediate vicinity of the bulbo-membranous juncture, and that these failures are due, first, to a lack

of proper knowledge of the anatomy and physiology of the immediate stricture and the effect the current has upon a portion of this structure, and, second, to improperly constructed instruments.

The membranous portion is not only constricted but is surrounded by the group of fibres called the cut-off muscle, which is one of the most spasmodic and irritable muscles in the body and often causes obstruction of the urethra by its spasmodic contraction—a condition known as spasmodic stricture.

So irritable is this muscle that the mere presence of a bougie in the bulbous portion of the urethra will at times cause spasmodic contraction. When we have added to this the irritation of a galvanic current (which seems to have a particularly irritable effect on this muscle) it is easily understood how a stricture in this locality is so complicated by spasm that it is impossible to pass the electrode through it. In ten cases of stricture occupying a space of about one inch lying within equal distance on either side of the bulbo-membranous juncture in which King was able to introduce a steel sound of certain size readily, it was utterly impossible to introduce an electrode of equal diameter when the current was turned on ever so slightly in seven cases out of the ten.

The small shaft and olive instrument usually employed is

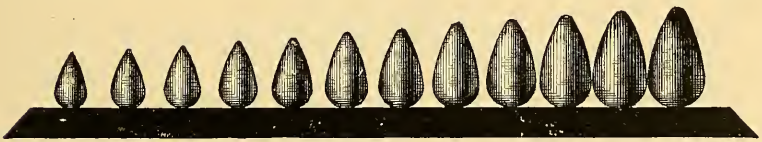


Fig. 290. Set of olive electrodes.

Handle for same.

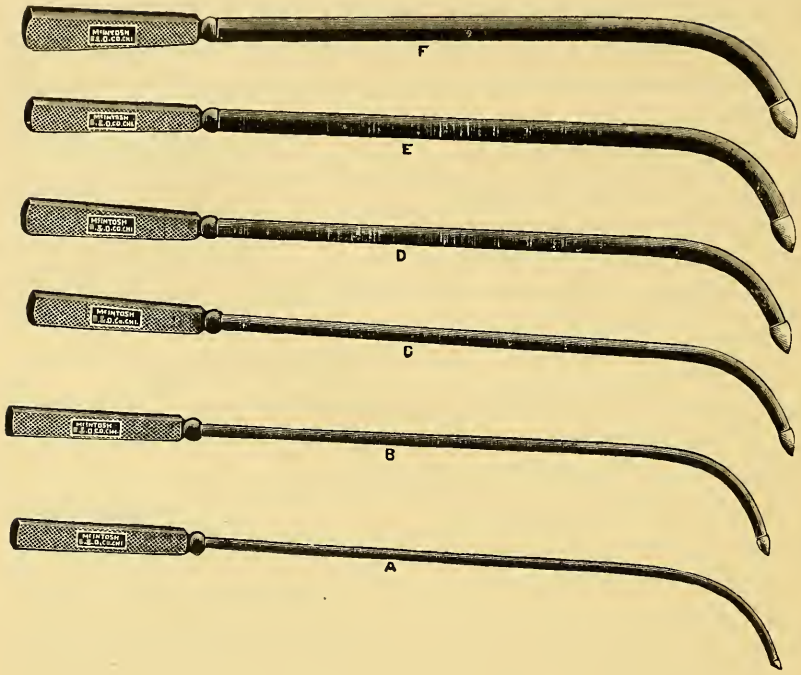


Fig. 291. Set of urethral electrodes.

considered to be unsuited to this portion of the urethra. No matter how correctly it is constructed or how skilfully handled, when it is introduced into the bulbous urethra and the current turned on it will in the majority of cases set up a spasm of the cut-off muscle.

I wish to call your attention to an instrument by which it is possible to obviate the spasm and treat a case of stricture successfully at this point with electricity. This is simply a steel sound with the proper curve so far as the point is concerned, and which has a bulb properly insulated three-eighths of an inch from the end, which is two sizes larger, American scale, than the rest of the instrument. (See Fig. 289.)

The size of the stricture is first diagnosed, the electrode is selected in which the projecting point corresponds to the size of the calibre, thus allowing the instrument to pass until the bulb is brought firmly against the stricture. After it is in position the current is turned on, and not before. If a spasm of the cut-off muscle takes place it contracts on the protecting

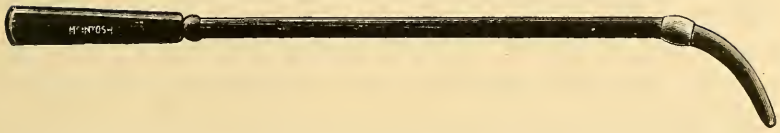


Fig. 292. Dr. D. D. Richardson's improved electrodes for treatment of urethral stricture—assorted sizes. In these instruments the hard rubber insulation at the distal end is sloped down to about four sizes smaller than the metalic bulb, so that when the stricture is engaged by the active part of the electrodes it is *on the stretch*, and having perfect contact with the metal presents the best conditions for electrolysis.

Fig. 293. Straight urethral electrode. (*Dr. C. W. Krauss.*)

steel point, which it firmly grasps for a moment or two and then relaxes. This may occur two or three times but not as a rule.

All that is necessary is to hold the instrument in position with slight pressure against the stricture. The spasm will soon cease and the full effect of the bulb in passing the stricture will be attained. This instrument is much easier introduced than the ordinary olive. We also get the quieting, soothing effect of the cold steel point, and it is just as certain in its curative effects. I have cured cases which I would have been unable to do anything with otherwise. (*King.*)

Urethral Spasm and Hyperæsthesia.—Place a medium-size

Fig. 294. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

felt or sponge covered electrode on the opposite side of the abdomen with the patient in the dorsal position on the operating table. Connect it with the negative pole of the high-tension induction coil apparatus. (The ordinary faradic battery will not do.)

Insert urethral electrode-sound of comfortable size into the

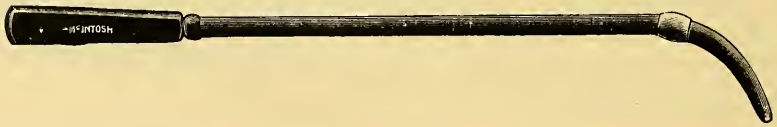


Fig. 295. Dr. D. D. Richardson's improved electrodes for treatment of urethral stricture—assorted sizes. In these instruments the hard rubber insulation at the distal end is sloped down to about four sizes smaller than the metalic bulb, so that when the stricture is engaged by the active part of the electrodes it is *on the stretch*, and having perfect contact with the metal presents the best conditions for electrolysis.

entire canal and connect it by a conducting wire with the positive pole. Insulate the part in contact with the meatus.

Switch the rapid vibrator and 1,500 yards of No. 36 coil into circuit with sufficient E. M. F. Regulate the dose through the rheostat until the current produces a firm sedative contraction of the tissues. Gradually increase the current strength to the point of tolerance and maintain the application for about fifteen minutes. Repeat p. r. n. until the spasmodic tendency and hyperæsthesia is subdued.

Discussion of Urethral Stricture.—Those who obtain perfectly satisfactory results by other measures to which they are accustomed need no word about the disputed merits of negative galvanic electrolysis in the treatment of urethral stricture. An interest in determining the true merits of the case is felt however by other practitioners who inquire for a presentation of the facts. There are many physicians who assert the superiority of the method. What will be attempted here by the author will be a fair statement of the case from selected remarks of those who speak from practical experience

in the treatment of patients. No personal bias is felt or expressed.

"After fourteen years' experience," Bryce puts his views into the following language:

In properly selected cases and with the requisite amount of skill and patience on the part of both the patient and the operator electrolysis will as certainly cure urethral stricture as water will put out fire.

Some of the most brilliant results we have ever accomplished in urethral work have been through the agency of electrolysis. We recall cases of stricture that had existed for many years that have been cured by electrolysis in our hands, and now as many as eight, ten and twelve years have elapsed without a single symptom of any trouble in this direction.

With this favorable result in our hands it may be wondered at by the reader when we state that at this time we seldom ever think of making use of this safe, certain and painless method of treating urethral stricture.

Our reason for not using electricity in this form will explain to some extent why so many excellent surgeons do not practise the method and actually deny its efficacy.

In certain forms of stricture and in *the hands of the hasty and inexperienced practitioner* this method is not only useless but can be made positively harmful by its abuse. To be successful with electrolysis in urethral stricture, as in all other classes of stricture or morbid growths or deposits, one must be thoroughly familiar with the pathological condition present and at the same time understand the principles involved in the action of the galvanic current in absorbing morbid tissue.

We must carefully avoid exciting inflammation and should ever bear in mind that we are endeavoring to help nature. The average practitioner seems to think that the stricture must be burned out by the current, while the real object and action of the current is to simply cause mild electrolytic decomposition to gradually soften the deposit and promote absorption by osmosis at the time of using the current and start the absorbents of the circulation to work, so that between the applications of the current much will be done by nature.

The process is slow and tedious and many physicians grow weary of a difficult case before they have made appreciable progress. In endeavoring to hurry up matters they increase the current strength and frequency of treatment and insure defeat by setting up sub-acute inflammation. The possibilities, advantages and disadvantages of electrolysis are:

1. In strictures consisting of simple hyperplastic deposits of

all degrees electrolysis carefully and scientifically used will effect a perfect and permanent cure—but in the treatment of even these selected cases a very long period of time will be required.

2. All objections being met it is the best method that can be found for strictures of the above class.

3. In strictures of fibrous bands and dense cicatricial tissue it is certainly worthless, and division or divulsion offers a far speedier and more certain method of relief.

4. A simple case of stricture properly selected and treated may be expected to be cured in a period of two or three months and under eight to twelve treatments.

5. Dr. S. M. Hogan states: "I use electricity in the treatment of strictures of the urethra, but now confine the method to those in the bulbous, membranous or prostatic portion. Strictures in the penile portion, especially *resilient* strictures and also cases which are subject to so-called urethral fever, I prefer to cut.

Holiday and Burton write:

"A urethral stricture is fibro-plastic material, a true electrolyte, and therefore susceptible of chemical decomposition. The method is applicable alike to all portions of the canal. Internal urethrotomy is limited to the penile portion of the urethra and restricted to the roof, upon which the incision is arbitrarily inflicted. Outside of the so-called annular stricture the fibro-plastic material is to be found in a large majority of cases upon the floor and sides of the canal; an incision therefore upon the roof enlarges the calibre only temporarily and at the expense of healthy tissue. The surgeon then has inflicted an unwarranted traumatism, the fibro-plastic material remaining *in statu quo*, and despite the instructions of the operator and the diligence of the patient the systematic employment of the sound for a prolonged period will not prevent a more serious contraction."

The same general facts apply to perineal section. Gradual dilatation is negatively more rational but the process is unsatisfactory and tedious, while the repeated passage of the instrument is not free from the danger of exciting new inflammation.

Rapid dilatation or divulsion is simply barbarous and should be expunged by conscientious practitioners.

The advantages of electrolysis in the treatment of strictures may be thus enumerated:

1. The operation cures.

2. The patient is not consigned to a bougie life as after other operative interferences.

3. There is no loss of time from business.

4. There is no hemorrhage, no urethral chill, no traumatism, no subsequent cicatrix, no incurvation of the penis, no relapse.

5. The operation is comparatively painless and devoid of danger.

Dr. J. W. Glass states:

"The tabulation of cases of stricture of the male urethra, treated by electrolysis, was long since abandoned by me, as my results have been so uniformly constant and good that I have not felt the need of this kind of evidence. Going over my records and picking out these cases would necessitate a great amount of labor. Therefore I will carefully estimate the number as 240. These have been treated in a general surgical practice without a single complication which might not follow the most gentle handling of the urethra. I prefer this method as the less painful and procuring greater permanency of results than either of the other methods."

The following cases are reported with sufficient clinical detail to give assistance to the practitioner who attempts to comprehend the method:

CASE I. F. S. B., age 23, single, February 13, 1888. Has discharge from the urethra for the past year after a urethritis which has not yielded to treatment. Has been under the care of an excellent well-known practitioner for stricture, who sent him to the hospital for treatment by electrolysis. Patient very nervous and sensitive.

Examination. Bougie à boule meets with a thickening of the walls of the urethra and a stricture of five inches from the meatus. There was some discharge from the urethra for which an injection was ordered.

February 20. Urethra improved, scarcely any discharge, but it is evident that the injection has no influence on the stricture. Bougies of thallin were ordered.

February 24. Urethra improved, electrolysis was used with No. 21 French acorn bulb straight electrode (negative) in the urethra and the positive sponge in the right hand. Three and one-half milliamperes were used for five minutes, during which time the electrode passed its whole length of six inches and through the stricture.

February 29. Patient felt better, is easier and the urine flows in a large stream. Bougies of thallin continued.

March 6. Electrolysis. No. 23 French egg-shaped, for seven minutes with a current of three milliamperes, passed in bladder.

March 23. Electrolysis. No. 25 French egg-shaped, passed easily into bladder. No discharge.

April 3. Electrolysis. No. 27 French egg-shaped, passed easily into bladder. Three milliamperes.

April 12. Electrolysis. No. 28 French egg-shaped, with a current of four milliamperes, passed easily into bladder.

May 1. Electrolysis. No. 28 French egg-shaped, passed easily into the bladder with a current of three milliamperes. Patient discharged, cured.

Patient has been kept under observation for four years, has not had a relapse, and on examination found that a steel sound, No. 28 French, passes easily into bladder without detecting any stricture.

CASE II. May 26, 1888. A. Z. J., aged 24, single, patient has had an urethritis for nine months and is still discharging with frequent micturitions, passing blood and great pain. A sound has been introduced but once. Small stream has been noticed and a stricture found. Bougie à boule on examination meets inflammatory contractions, all sub-acute, which are sensitive to the touch. Strictures were found at three and five inches from meatus. Urethra was very sensitive and for this reason electrolysis was not used. Mild injections were ordered and potass citrat, etc., to render urine alkaline and later bougies of thallin.

June 18. Patient feels better, but there are still acute symptoms. Urethra is very sensitive and bleeds on the slightest touch of a sound or electrode, therefore electrolysis is contra-indicated.

April 8, 1889. Patient has not been seen since last June, discharges only a very little and no acute symptoms. Stricture is worse. At the hospital electrolysis was used with a No. 14 French egg-shaped electrode which passed only to six inches.

April 15. Filiform guide was introduced, and after some manipulations passed into bladder. Over this a No. 9 French tunnelled electrode was passed with a current of four milliamperes slowly through both strictures and was arrested at seven inches.

May 6. Electrolysis. No. 17 French passed only to seven inches, and was there stopped.

May 25. Electrolysis. No. 17 French passed only to seven inches, three milliamperes.

June 22. Electrolysis. No. 20 French acorn bulb passed to seven inches from meatus with three and one-half milliamperes.

June 30. Electrolysis. No. 21 French acorn bulb passed its whole length six inches.

July 15. Electrolysis. Filiform guide No. 9 French combination and tunnelled passed for the first time into the bladder, which was not attempted before on account of the severe spasm of the bladder. The small size No. 9 had been selected in order to pass the instrument into the bladder, which would have been impossible to do with a larger instrument.

July 22. Electrolysis. No. 20 French acorn bulb, passed its whole length, six and one-half inches.

August 20. Electrolysis. No. 21 French egg-shaped, passed easily into bladder with a current of four milliamperes.

September 2. Electrolysis. No. 23 French egg-shaped, passes slowly through stricture with a current of four milliamperes.

September 15. Electrolysis. No. 25 French egg-shaped, passed easily into bladder with a current of four milliamperes.

September 22. Electrolysis. No. 26 French egg-shaped, passed into bladder with a current of four milliamperes. This was a very severe case in which, at times, scarcely a filiform guide would pass, and the treatment's progress was impeded by the patient's irregularity in having electrolysis used. Patient has been kept under observation and has been re-examined several times, and no relapse has taken place.

CASE III. IMPASSABLE STRICTURE.—B. C., aged thirty-seven, single. Has a very severe stricture; dates back seven years; very small stream, at times urine only flows after severe straining; hemorrhage from urethra; urine always scalding; cystitis causes severe painful spasm. The whole mucous lining of urethra is much congested, and granulations with erosions. No instrument will pass further than five and one-half inches where the stricture is hard, almost cartilaginous, and not even a filiform guide will pass. There is a profuse hemorrhage from this place on the slightest touch with a bougie à boule, and even with a filiform guide. He has been treated by local applications, per endoscope, for the granulations and to allay the hemorrhage. During October, 1892, he had an attack of malaria of such a degree that he had to remain at home and in bed. The meanwhile the stricture was impassable and urine dribbled only under severe straining, and cystitis with spasms. Local applications by means of soluble gelatine bougies were used during November and December, 1892.

December 27. Filiform guide passed into bladder for the first time, over which a tunnelled combination electrode, No. 9 French, passed into the bladder. Urine was drawn off and bladder washed out with a solution of acid of boracic.

January 4, 1893. Filiform guide in bladder over which a

tunnelled combination electrode No. 11 French egg-shaped electrolysis four milliamperes, nine minutes, passed slowly through the stricture into the bladder,

January 10. Electrolysis. No. 12 French combination electrode tunnelled over a filiform guide with five milliamperes passed into the bladder in five minutes.

January 16. Electrolysis. No. 14 French combination passed into the bladder with four milliamperes in ten minutes.

January 23. Electrolysis. No. 17 French egg-shaped passed slowly into the bladder with a current of four milliamperes for ten minutes.

January 30. Electrolysis. No. 20 French egg-shaped passed into the bladder, five milliamperes, ten minutes.

February 8. Electrolysis. No. 21 French egg-shaped, four milliamperes, nine minutes, passed into the bladder.

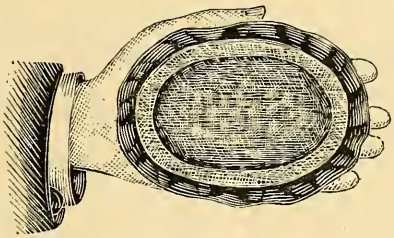
February 15. Electrolysis. No. 23 French egg-shaped passed into the bladder five milliamperes, ten minutes.

February 24. Electrolysis. No. 24 French egg-shaped passed into the bladder, five milliamperes, nine minutes. This case is still under observation and I may report it later on, but consider it the most severe test that electrolysis could have ; as it was impassable and urethrotomy seemed to be the only possible cure. But electrolysis accomplished it without any bad result, or any interference with the patient's usual occupation. I have assisted in several operations for stricture of the rectum and enlarged prostate, by means of electrolysis, with very favorable results. (*McFadden.*)

A second method of treating urethral stricture by electrolysis has been suggested by a French physician who has practised it for about three years and who visited this country and demonstrated it in New York in 1895.

Linear Electrolysis ; Fort's Method. Copious antiseptic irrigations are used both before and after treatment. Moisten a sponge-covered, flat electrode in a one per cent. hot-water

Fig. 296. Fort's electrolizer. (*McIntosh.*)



POSITIVE.

Fig. 297. Sponge-covered flat electrode.

solution of bicarbonate of soda and connect it with the positive pole. Apply it with firm pressure upon the opposite side of the lower abdomen. Pass the filiform guide down the urethra until the electrolytic blade rests on the face of the stricture, connect it with the negative galvanic pole, and gradually increase the constant current strength from zero up to at least 10 mil. or beyond this to comfortable tolerance. Push the blade gently downward until it traverses the stricture. Repeat same if more than one stricture exists. Haste is not essential. The time involved varies from thirty seconds to three minutes, and the slower action is probably more effectual.

Judicious treatment after the operation is essential to success. It consists in the passage of bougies from time to time to prevent relapse. No. 24. French is the usual maximum size passed. Fort passes a sound on the third day after the operation and instructs the patient to pass a sound, No. 22 or 24, once every month or second month. In hard strictures the method is less efficient or fails entirely.

I have electrolyzers of different sizes, large and small. My own experience teaches me that a small blade may be used to dilate the canal as well as a large one, because the muscular fibres of the urethra contract when the blade touches them, so that it is the stricture which is electrolyzed on the blade, and not the blade which acts upon the stricture.

I have not experimented to discover the maximum of current, but the dosage depends upon the tolerance of the patient. Ten mil. is usually employed, and I have seen the meter register as much as 40 mil. without ill effects. The operation is

effective just the same while the pain is not sensibly increased. I always recommend the operator not to force or push the instrument, but simply to hold it steady. I do not practise divulsion. If divulsion occurred there would be pain, tearing and hemorrhage; but there is neither pain nor hemorrhage and consequently no tearing.

The question has arisen, Can a current of 10 mil. enlarge a stricture eleven numbers, or even less by electrolysis? I reply that I enlarge not only eleven numbers, but up to eighteen or nineteen, and without using any force. I have a considerable body of notes relating to patients with almost impassable strictures through which after the operation I was able to pass a No. 22 bougie and even a No. 24 French.

In its action my instrument resembles to some extent Maisonneuve's urethrotome, which was so universally recommended. It differs from this latter only in that it does not cut and does not tend to produce any of the accidents so frequent after urethrotomy.

The success of the operation depends upon the form of my instrument, which acts upon one single line and with great swiftness, like the urethrotome of Maisonneuve. But the tightest strictures may be operated upon, provided the guide bougie can pass through.

Any soft stricture may be managed with a current of ten milliamperes and without the slightest forcing. In order to prevent relapses, it is necessary to pass a bougie along the canal from time to time. Up to date I have operated upon some thirty-five hundred patients, and my record cannot be affected by a simple statement.

J. A. FORT, M. D.

PARIS, FRANCE, July, 1897.

Dr. R. W. Taylor, of New York, who observed Fort operate upon fifteen cases, reported the method, and the following remarks are cited from his résumé.

The electrolyzer resembles Maisonneuve's urethrotome when the filiform guide has been attached and the knife has been pushed down the grooved staff. It merely consists of two equal parts, the distal one being the filiform guide and the proximal one a fine, soft bougie (calibre about 6 or 8 French scale), through the whole length of which there is a thin metallic wire, bent to form an obtuse conical projection just before the junction of the proximal with the flexible distal portion. This platinum blade is the active instrument.

In general, it may be stated that the operation is nearly

painless; some patients make an outcry from fear, while others complain of a slight stabbing sensation. There may be no hemorrhage at all, or the flow of blood may be slight; it never is sufficient to cause any uneasiness. With our precise antiseptic methods, Maisonneuve's operation may now be done in most cases without fear of sepsis, and, as a rule, little or no fever is present. It is remarkable to observe how free patients operated upon by Fort's method are from febrile movement or any troublesome symptom. The writer was struck by the calm confidence of the Paris professor in not sending patients operated upon to bed; indeed, in some cases, he allowed them to go out of the hospital, enjoining them to return for subsequent irrigation and dilatation. This course seemed startling to cautious surgeons who, in the past, even when using intelligent antisepsis, were always a little anxious for a patient after a Maisonneuve's operation; still, in more than a dozen cases, the writer has seen no untoward result.

Another point which is to be commended is developed in the after-treatment of strictures thus operated upon by Dr. Fort. He contents himself in these cases with the passage of olivary bougies of a maximum calibre of 24 French scale. In this conservative course he has the warm endorsement of the writer, for it is his firm conviction that if the lumen of a man's urethra, after an operation for organic stricture, can be maintained at a calibre of 24 French scale, that man is a lucky individual, and will be in far better condition (and certainly will not be in jeopardy) than if he were persistently treated with much larger sounds. Judicious treatment of strictured urethræ after operations is just as important as the cutting operation itself. From a study of the fifteen cases already mentioned, the writer is led to think that Dr. Fort's method is applicable to annular and bridle strictures in which the stricture tissue is not exceedingly dense or too exuberant. It is not a treatment, as a rule, by which a route can be tunnelled through long, very dense and copious inodular urethral stenoses. Thus, in the case of a man having a well-defined, not very long or thick stricture, at four inches down the canal, this contraction readily yielded to the electrolyzer, while a large, dense, inodular stricture mass at the bulbo-membranous junction was wholly unaffected, and only traversed by Maisonneuve's guide and knife. Again, in another case, there was a stenosis of the urethra beginning just behind the glans and extending into the subpubic course, and having a length of four inches and a calibre of 8 French scale, the electrolyzer could make no headway whatever. In this case gradual dilatation is producing good results. The writer feels confi-

dent that many cases of firm stricture in the bulbous urethra may be traversed by Fort's instrument, whereas most New York surgeons would have in the past subjected them to external urethrotomy. The electrolyzer may lessen the number of cases of external urethrotomy, but it will not render the operation obsolete. The electrolyzer is useful, in that it decomposes a segment of the stenosed urethral canal, and then by destruction of tissue gives more relief than the thin incision of Maisonneuve's blade, and it does this with precision and almost without hemorrhage. Added to this, there need be no septic complications. Of the ultimate outcome of the operation, the writer cannot speak with authority, but it is fair to assume that if gradual dilatation is regularly, carefully and persistently followed for a long period, the man may be wholly free from all distressing or dangerous symptoms, and he may void his urine with complacency and comfort.

CHAPTER XXXV.

TREATMENT OF PROSTATIC DISEASE.

Atrophy of the prostate. Acute congestion of the prostate. Chronic prostatitis. Treatment of enlarged prostates. Discussion upon different methods.

Atrophy of the Prostate. — Insert a flattened metallic electrode into the rectum so that the bulb rests against the prostate. Connect it with the negative pole of the high-tension induction coil apparatus.

Press a sponge-covered hand electrode upon the anterior

Fig. 298. Electrode insulated on under half.

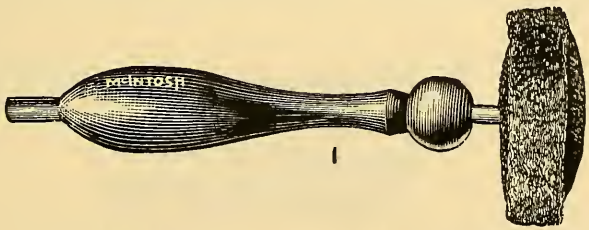


Fig. 299. Sponge-covered hand electrode.

part of the perineum and connect it with the positive pole. The patient should be in the lithotomy position on the operating table.

Switch the combined No. 21 and No. 32 secondary coils, the rapid vibrator and three or four cells in the circuit. Regulate the current strength by means of the rheostat from zero up to comfortable tolerance, and this may be increased by em-

ploying as large an external electrode as the situation will accommodate. Continue the application for ten or fifteen minutes. Repeat three or four times a week for two or three months, or until the functional symptoms are relieved.

As the case improves the application of the current should be managed to secure a gradual increase of stimulating effects.

In the chapter describing the management of bipolar faradization the reader will find directions in full for regulating the dosage of high-tension induction coil currents to produce different degrees of effect from the sedation of acute congestion to decided stimulation. During the latter part of each sitting after all irritability ceases switch the slow interrupter into circuit and cause a few stimulating muscular contractions.

Acute Congestion of the Prostate.—In an acute condition, such as may be caused in young or middle-aged men by riding too vigorously upon an ill-fitting saddle adjusted so that the rider's weight pounds improperly upon the pubic arch instead of resting upon the tuberosities of the ischium, an external application of faradic sedation will usually promptly afford relief and comfort.

Place a felt or sponge covered electrode, about 4 × 4, under

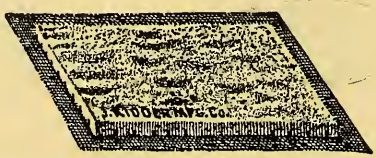


Fig. 300. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

the lumbar spine with the patient in the lithotomy position on the operating table. Connect this with the negative pole of the high-tension induction coil apparatus.

Moisten an ordinary sponge-covered hand electrode in hot water, connect it with the positive pole, and press it firmly upon the perineum with the scrotum drawn forward by the patient out of the way.

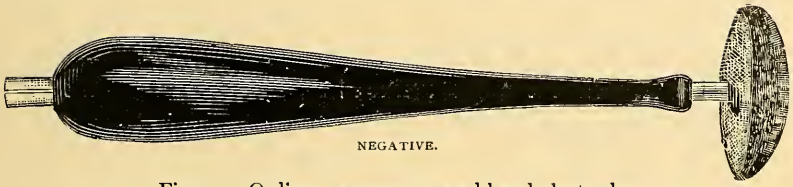


Fig. 301. Ordinary sponge-covered hand electrode.

Switch into circuit the 1,000 yard No. 36 coil, rapid vibrator and four cells. Gradually increase the current through the rheostat from zero until it grasps the tissues with a firm and soothing contraction. In two or three moments, as tolerance increases again increase the dose, and allow it to pass steadily for ten or more minutes. Then slowly reduce to zero and close the sitting.

Repeat once or twice a day for a few times.

This method may be applied in the simplest cases, or if the patient objects to " internal " applications.

The more rapidly effective method is as follows:

With the patient in the same position and the negative electrode upon the perineum insert into the rectum a bare

Fig. 302. Rectal electrode, bare metal.

metal electrode and support it in contact with the congested gland. Connect this with the positive pole. Beginning with the 1,500 yard coil regulate the dose until it is agreeably felt through the tissues. If this requires a different coil it takes but a moment to test the tolerance and determine the proper coil to use in any given case, as the different coils in the author's apparatus are selected at will by simply moving a single switch arm from one button to another.

Manage the sitting in the same manner described above. Repeat p. r. n. until relief is sufficient. There is not only no

pain connected with faradic sedation with the high-tension induction coil current, but on the contrary it is anti-congestive and sedative to a very marked degree. The common faradic battery will not do this kind of work.

Chronic Prostatitis.—Good results have been reported by the following method:

Moisten a felt-covered, flat electrode, about 6×9, in the usual hot-water solution of bicarbonate of soda and place it upon

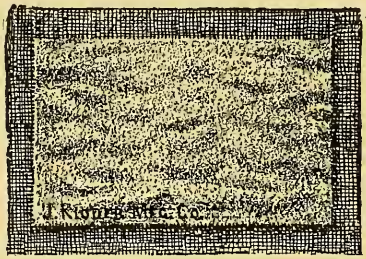


Fig. 303. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

the lower abdomen. Retain it with firm contact, either by the weight of the patient's hands or a small shot-bag.

Insert a prostatic electrode of pure tin into the rectum so as

Fig. 304. Electrode insulated on under half.

to press gently against the surface of the gland. At the first sitting connect the internal electrode with the positive pole of the galvanic battery and the external electrode with the negative.

Gradually increase the constant current through the rheostat from zero up to 5, 7 or 10 mil. or comfortable tolerance, and in about five minutes reduce gradually to zero.

If the gland is soft, continue the use of the positive current at intervals of about one week, increasing the dosage and

length of the application according to the increasing tolerance.

If the gland is indurated, or after the initial use of the positive pole allays local irritation and establishes tolerance, connect the internal electrode with the negative pole. In this case a larger dosage will be tolerated, but the management of the electrodes is exactly the same.

In case of induration (a more difficult condition to affect than soft enlargement) maintain the current at the point of comfortable tolerance for about five minutes. Then briefly increase the current to the point of maximum tolerance for two minutes and again reduce to the former dose. This brief maximum may reach 25, 30, 40 or more mil. at different times but must be regulated by the skill of the operator and the tolerance of the tissues. After reducing the dose from the maximum about one-half hold steadily for a moment and then continue to gradually reduce to zero.

After completing the action of the constant current, transfer the conducting cords to the high-tension induction coil apparatus with the positive pole in the rectum (the electrodes remain undisturbed) and administer a few moments' faradic

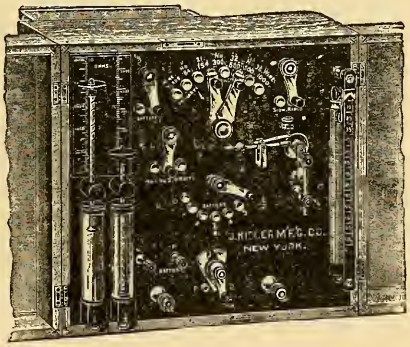


Fig. 305. High tension apparatus.

sedation both to allay any irritation that may exist and to procure beneficial vaso-constrictor effects. This application is

most useful in the early stage of treatment, and at any subsequent time when irritability may develop.

When the condition is not irritable the electrolytic action of the constant galvanic current may be supplemented by producing a few strong contractions through the tissues by switching the interrupter into circuit and regulating the dosage in the usual manner.

Repeat at intervals of about four days until improvement ceases.

Treatment of Enlarged Prostate.—Conjointly with indicated medical measures of relief the plan of electrical treatment involves softening, liquefying and absorbing, hyperplastic material and shrinking down the enlarged gland on both anterior and posterior surfaces. To accomplish this and to proceed without irritation four variations of method may be used alternately, thus permitting active and continuous treatment, impossible with a single routine.

1. To relieve local tenderness initiate treatment by faradic sedation as described in the treatment of acute prostatic congestion. Commence the regular treatment of all cases in this manner.

2. Pass into the bladder (so as to get over and past the entire prostate) a pure tin urethral sound electrode suited to the size of the canal and connect it with the negative galvanic pole. Lubricate it with glycerine only.

Press upon the perineum externally a carbon hand electrode covered with a freshly prepared layer of absorbent cotton saturated in the usual hot-water solution of bicarbonate of soda. Connect this with the positive pole.

Cautiously increase the constant galvanic current through the rheostat from zero up to 3, 5 or 7 mil., keeping within the comfortable tolerance of the tissues to avoid irritation. Continue the action of the current about five minutes at the first galvanic treatment, and gradually increase to ten minutes as improvement develops an increase of tolerance. When improvement progresses the amperage of the current may also

be increased accordingly, but the indications for positive electrolysis generally call for mild currents only.

3. Insert a prostatic electrode of pure tin in the rectum against the gland. Connect it with the negative pole of the galvanic battery. Press the external electrode (positive) over the pubes and pass a mild galvanic current as in section 2.

4. Both electrodes internal, the sound in the urethra and over the prostate, the bulb electrode in the rectum under the prostate, constant galvanic dosage regulated to comfortable tolerance. At different sittings the polarity of the internal electrodes may be alternated, but generally connect the intra-urethral with the negative pole.

The maximum dosage and duration of *séance* must be regulated by the tolerance of the tissues at different stages of the treatment.

At the close of each *séance* cause contractions of the muscular fibres by a few interruptions of the galvanic current carefully reduced to avoid any disagreeable sensation, or transfer the cords to the induction coil apparatus and close the sitting with about five minutes of firm pressure with the rapidly interrupted high-tension current followed by a few slow interruptions.

The result of these methods skilfully alternated and persistently employed, at first daily, until faradic sedation performs its work, and continued three or four times a week, will depend upon the amount of hypertrophy to be reduced. The currents employed cannot deal with a prostate the size of an orange as quickly as with one but half the size, hence early treatment is important prophylaxis. The symptoms however should begin to yield after a few treatments. The pain, weakness of the knees, frequent and difficult micturition, loss of sleep, nervous depression and anxiety are all helped. From two to four months will give a fair start towards anatomical reduction.

About one year should be allowed for total treatment, with occasional rests if the case is an advanced one, but it is better

for the patient to insure against advanced hypertrophy by seeking electrolytic treatment at an early stage when the process may be more easily arrested and comfort preserved with much less difficulty. Delay and neglect do not benefit these cases nor improve the prognosis. Whether or not electricity is a sure cure it is a conservative measure that is worth trying before the patient begins to be alarmed about the necessity of a surgical operation.

Men who are advanced in years and have enlarged prostates are not seldom in poor general health. Improvement in their general condition tends to increase local tonicity and lessen the ill-effects of local lesions. As an auxiliary to other treatment the static apparatus possesses great usefulness. By reference to the chapters upon static electricity in debilities of the aged, chronic cachexias, and tonic effects in various conditions the reader will find full directions for conducting nutritional and tonic administrations of static electricity.

Enlarged Prostate : Discussion.—The treatment of senile hypertrophy of the prostate gland by application of the familiar principles of galvanic electrolysis is not so intrinsically difficult or disappointing in results as it is tedious to both physician and patient. In surgery the operator gets through very quickly and the patient endures the convalescence and accepts the results without taxing the operator's time.

Much has been written about relieving the pitiful condition to which advanced prostatic hypertrophy reduces its victim. Those who are acquainted with the capabilities of electrolytic action upon hyperplasias of glandular structure in other parts of the body believe that a pathological condition which can be successfully attacked elsewhere is amenable to the same process of treatment in the male pelvis. The moral which the pitiful state of large hypertrophy points to is early treatment when the process may be arrested in probably a majority of cases, if not in all cases. If it is possible to arrest and reduce hyperplasia and relieve symptoms at any stage it is obviously desirable to do so early.

To enable the reader to form a practical judgment in regard to comparative methods of dealing with prostatic hypertrophy the following summary is appended:

By means of electrolysis this condition (enlargement of the prostate) is ordinarily curable and micturition becomes free as soon as the pressure of the mass is relieved. When however from the general laxative of perineal tissues in old men the whole contents of the pelvis sag down relief is usually sought from the painful symptoms of pressure and cystitis, and this, to be effective, must be long and tedious. But, even if protracted, electricity is the only remedy which has proven effective so far as I know and is readily applied by a general practitioner. (*Hutchinson.*)

What to do for prostatic hypertrophy is a question I have asked for the last quarter of a century and never had any satisfactory reply until the past two years, when I have found that galvanic electrolysis will control and cure the hypertrophy, just the same as it will any morbid growth. My father and one brother, a physician, both died from enlarged prostates, and my own prostate began to enlarge and cause frequent micturition from horseback riding during the muddy season in Oregon from '90 to '94. I found that corn silk, sanmetto, hyoscyamus and like remedies would relieve the vesical irritation, but I never found or heard of any medicine that would reduce the enlargement.

For two years past I have made a special study and practice of electro-therapeutics, and found the galvanic current to be a curative treatment, applied as follows:

I made an electrode of a round carbon, six inches long and one-third of an inch diameter, procured from the electric light company, bored a hole of the right size for the cord tip in one end, insulated with three coats of shellac all but an inch of the other end, and also insulated one lateral half of that inch, wet it with water and introduced it into the rectum, with the uninsulated surface pressed gently against the gland with the negative pole attached, and a large sponge electrode to the anode, which was placed on the lower abdomen. I then turned on the current slowly, with a controller, until five milliamperes were reached, and continued this for from five to eight minutes, and then slowly turned off, to avoid shock. This was repeated once a week, and alternated with urethral electrolysis with a medium-sized, olive-tipped electrode, insulated on the superior surface, where no current is needed, attached to the cathode, with the anode on the perineum. The olive was slowly worked

along the prostatic urethra, with such a current as I could bear, being careful to avoid shock or cauterization.

The result is all that can be desired; the vesical irritation is gone, micturition normal, prostate scarcely to be found per rectum, and although it may grow again some time, I am confident I have a potent remedy for the trouble.

I am using electrolysis with success in all morbid growths, tumors, piles, turbinated hypertrophies and stricture, fistulas, chancroids, in fact, nearly all surgical diseases. (*Bickford.*)

A physician in New York informed the author in June, 1896, that he had personally treated five cases of enlarged prostates, and not only had confidence in the electrolytic method but believed it to be "better than castration."

No Apostoli has thus far appeared to guide us to the great truths undoubtedly hidden in the possibilities of scientific electro-therapy applied to the prostate, seminal vesicles, vas deferens and testicles—the annalogues of the uterus, tubes and ovaries. Far more information can be gained of the condition of the prostate by the rectal touch than by explorations of the urethra. The same avenue (rectum) is peculiarly well adapted to the interpolar and modified polar actions of electricity, the insensitiveness of the rectum permitting really enormous current strengths to be passed through the diseased parts.

The field of electricity in the various conditions of the male organs is peculiarly apparent to the physician familiar with its successful application to the diseases of women. As a remedy for a chronic catarrhal inflammation of a gland there is nothing superior to the local action of the galvanic current. The negative pole may be applied to the prostatic urethra by means of olive-pointed sounds. The positive pole is however best when small currents of 5, 10 or 20 mil. are used with electrodes of platinum or pure tin. If the *séance* is three to five minutes five to eight mil. is sufficient current strength repeated not oftener than once a week.

The insertion of an electrode into the *urethra* to apply *faradic* currents to the prostate and contiguous parts is unnecessary and never warrantable, as they are equally well directed to the same parts through the walls of the rectum and their high voltage makes resistance negligible.

Rectal applications of the galvanic current are usually sufficient for most cases of deranged functionation and incipient enlargements of the prostate. The negative electrode within the rectum is pressed against the under surface of the gland.

In order that the bulk of the current may penetrate the prostate and its adjacent structures the positive electrode must be upon the lower abdomen and should be a felt-covered, flat electrode, about 6×9, and well moistened in a hot-water solution of bicarbonate of soda.

The effect of proper treatment thus applied is but slightly unpleasant, and its power to cause absorption of effused and adventitious material and promote healthy contractions of non-striated muscle is very great.

Shrinkage of the prostate itself is promoted by the conjoint use of faradic stimulation with the same electrodes arranged as just described. By carrying the rectal electrode a little higher the method may be used as a powerful stimulus to an atonic bladder which is so often found associated with prostatic enlargements. (*Massey.*)

Operative Measures.—Operative interference is indicated in late stages when catheterism becomes difficult, painful or necessarily more frequent than every three hours, or when decomposition of residual urine occurs and persists despite irrigation, or when interference with sleep is so great as to injure the general health, or when persistently recurring spasm of the bladder is not relieved by catheter or medication.

The procedures given by Munn are: 1. Those which aim at relief of the bladder by simply providing drainage, either perineal or supra-pubic. 2. Operations aiming at permanent relief by inducing atrophy of the prostate gland, to wit, castration, ergot injections or ligation of the spermatic arteries. 3. Operations aiming at permanent relief by incision or excision of a part or the whole of the obstructing growth.

The result of ten operations reported by Dr. Munn was two complete recoveries, five partial recoveries and three deaths.

Castration for Enlarged Prostate..—Dr. A. T. Cabot (*Annals of Surgery*, September, 1896), in an exhaustive paper on this subject, reaches the following conclusions: 1. In the matter of mortality the operation of prostatectomy has a slight advantage over castration. It seems probable that, with later statistics reflecting the last improvements in the technique of prostatectomy, this advantage would be further increased. 2. Prostatectomy has the further advantage that it allows of a thorough examination of the bladder and of the discovery

and correction of other conditions not before suspected. Stones are frequently removed in this way without adding to the gravity of the operation. In several reported cases of castration the absence of improvement has led to the subsequent discovery of stones which have required other operations for their removal. 3. Prostatectomy has, on the other hand, the disadvantages that it confines the patient for a longer time and that it is sometimes followed by a fistula. This occurred in one of the forty-two cases used in this paper. 4. It is too soon to know whether any permanent loss of vigor follows castration when done on old men. The nervous effects which sometimes immediately follow the operation suggest a suspicion that with the testes the system may lose some tonic effect exerted by those organs. 5. The functional results of the two operations seem, at present, to be as nearly equal as possible, and the tendency to relapse shows itself in about the same proportion of cases after either operation. 6. The reduction in the size of the prostate after castration is largely due to a diminution of congestion. Later a degeneration and absorption of considerable portions of the gland may occur. The glandular elements are particularly affected by this atrophy. 7. Castration would seem to be especially efficacious in cases of large and tense prostates when the obstruction is due to pressure of the lateral lobes upon the urethra. 8. Castration is of but little use in myomatous and fibrous prostates. 9. Prostatectomy has its especial field in the treatment of obstructive projections which act in a valvular way to close the urethra. There is, however, no form of prostatic obstruction which a skilful operator may not correct by prostatectomy. 10. Prostatectomy is, then, applicable to more cases than is castration, and especially to be selected when an inflamed condition of the bladder makes drainage desirable.

Dr. McEwan read a paper on this subject at the last meeting of the Brit. Med. Assoc. and summed up his conclusions as follows:

"1. In many cases castration causes more or less atrophy of the prostate. 2. Atrophy occurs most commonly when the prostate is soft, 3. It is of most value when the enlargement is general. 4. Cystitis may be relieved or cured. 5. In marked cystitis, drainage is better. 6. It may do away with the necessity for the use of the catheter. 7. Or the catheter may be required less frequently. 8. Resection of the vas deferens acts more slowly, but the effect is similar."

Resection of Vasa Deferentia for Prostatic Hypertrophy.—Cases that have been published show that this operation reduces the frequency of micturition, relieves the pain,

and in many instances completely checks pyuria. The permanence of this amelioration has not yet been proven. Resection causes modifications in the glandular tissue, relieves and sometimes abolishes the vesico-prostatic congestion, and in this way, the author believes, checks the symptoms of advanced prostatic hypertrophy. Dividing the vasa deferens suppresses the function of the testicle, and probably in this way induces rest of the whole urinary apparatus. The operation is of but slight or no benefit, other than relieving pain in advanced cases where great structural changes have occurred. Its best results occur when cystitis, retention and hematuria result from congestion in the middle stages of the disease.

CHAPTER XXXVI.

TREATMENT OF RECTAL CONDITIONS.

Hemorrhoids. Rectal stricture. Rectal ulcer. Peripheral irritations. Prolapsus ani.

Hemorrhoids.—Surgical methods and the galvano-cautery current deal with most of these cases which get beyond relief by ordinary medication, suppositories, etc., but just as there is a field for medicine in the treatment of hemorrhoids, so there is also a field for non-surgical applications of both galvanic and faradic currents.

If the condition is a simple state of atonic vascularity the muscle fibres of the adjacent parts may be toned up by the treatment described for prolapsus ani.

If the case has previously been treated by the injection method, leaving a dry, hard lump, run a sharp hagadorn needle through the base, connect it with the negative pole of the ordinary galvanic battery (not cautery), place a positive felt-covered electrode under the sacrum and increase the constant galvanic current through a rheostat from zero until destructive action is seen at the needle. About one minute with a current of three to five mil. will suffice, depending on the size of the mass and the needle. Remove the electrodes and leave the rest to nature. One application suffices.

If the tumors are of the bleeding variety they may be successfully treated by cupric electrolysis.

Previously regulate the action of the bowels and diet. Moisten a felt-covered, flat electrode, about 4×6, in the usual hot-water solution of bicarbonate of soda, connect it with the negative pole of the galvanic battery and place it under the

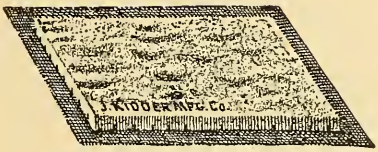


Fig. 306. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

sacrum. Expose the hemorrhoids if possible, but if not they may be treated without. Connect with the positive pole of the battery the copper tip electrode made for this purpose and insulated on one side. Brighten the copper part with fine

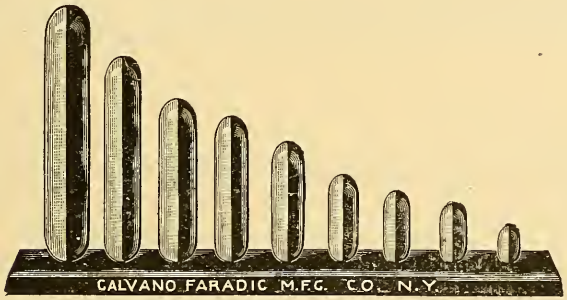


Fig. 307. Set of semi-insulated bulbs for metallic electrolysis.

emery paper and apply the metal surface to the mucous membrane. Gradually increase the constant galvanic current through the rheostat until either the patient complains of the burning sensation or the meter registers between 10 and 15 mil. Larger doses produce too much subsequent irritation. Rub the copper surface slowly over the tumor until a visible deposit of the green astringent salt is driven into the tissues. This may require a longer time with a mild current than with currents above 10 mil., but the patient will find the result more satisfactory.

After the first sitting prescribe an anodyne suppository, in-

serted p. r. n. until irritation ceases, and maintain proper action of the bowels. In about ten days observe if a second application is needed and proceed as before. The effect of cupric electrolysis is at first irritating but is followed by the coagulating and drying action which is desired to improve the condition.

While the treatment of hemorrhoids by medical currents must be supplemented by attention to the functions of the liver the above methods may be useful to some patients and prevent them from requiring surgical procedures at a later date. Moreover the non-surgical practitioner can use them with facility. They will never be popular methods for general application, but possess advantages which give them a moderate value. In the case of bleeding hemorrhoids the application of cupric electrolysis will arrest the bleeding at the first treatment. Do not puncture vascular hemorrhoids with needles.

Rectal Stricture.—"Stricture of the rectum requires both palliative and operative treatment. The object in the first is to alleviate the pain, that the patient may obtain rest, and is best done by keeping the bowel clean by flushing it with antiseptic solutions, to be followed up by the use of soothing lotions and ointments. The operative precedures resorted to for the relief of strictures are three in number :

1. Colotomy.
2. Posterior Proctotomy.
3. Dilation.
   (*a*) Gradual or (*b*) forcible.

In cancer the indications for treatment are almost identical with those of stricture." (*From a Surgical Journal.*)

Electrical treatment is as follows:

Moisten a felt-covered, flat electrode, 6×9, in a one or two per cent. hot-water solution of soda bicarbonate, connect it with the positive pole of the galvanic apparatus and place it beneath the sacrum with the patient in the lithotomy position. At the next sitting place the external electrode on the abdomen and alternate thereafter.

Connect with the negative pole any form of metallic electrode, either olive tip or the ordinary rectal shape, a little

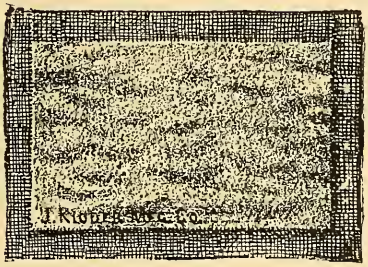


Fig. 308. Fine felt or sponge covered electrode--assorted sizes with soft rubber insulating backs.

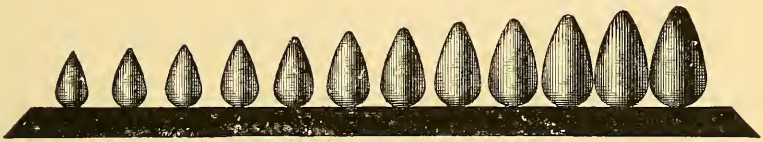


Fig. 309. Set of olive electrodes.

Handle for same.

larger than will pass through the stricture with mild pressure. Warm the rectal electrode, lubricate it with a little glycerine and insert it as far as it will go. Next gradually increase the constant galvanic current through the rheostat from zero to about 5 mil. if the electrode is very small, or 10 mil. or 15 mil. if the area of contact is sufficient to afford comfortable tolerance. Maintain the electrode with gentle pressure until it passes through the stricture and is again withdrawn slowly. If the stricture is firm and hard and especially if due to a neoplasm, the current must be increased until it is effective, and this must be regulated by the operator's judgment in each individual case. The duration of each sitting is the time it takes to pass the stricture both going in and coming out, and will vary

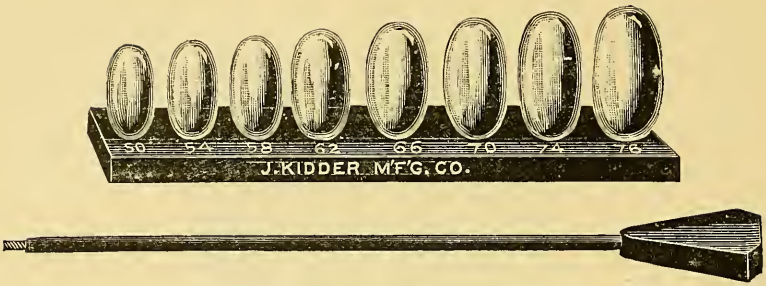


Fig. 310. Copper ellipsoidal bulbs, for metallic electrolysis or negative dilatation.

at different stages of the case. From ten to twenty minutes may be the average. Before withdrawing the electrode from the rectum reduce the current to zero, then remove both electrodes and close the sitting. Repeat every four or six days.

Clinical Case.—Female, aged 40. Hemorrhoids had previously been treated by the injection method with subsequent ulceration and extensive induration—so extensive as to involve the entire circumference of the bowel and constrict it. Only fluid stools could be voided, and the largest diameter which would pass the stricture was $\frac{5}{16}$ of an inch.

Treatment was begun with the constant galvanic current, positive electrode under sacrum, negative olive of bare metal applied to lesion. Current strength usually 10 to 15 mil., gradually increased from zero and maintained until olive passed the stricture and returned. First *séance* was under anæsthesia and an olive ½ inch in diameter was passed. Three days latter under cocaine I passed a $\frac{9}{16}$ olive and waited a week to observe results. These were encouraging and the patient was given one or two treatments per week as circumstances permitted, until she had received twenty and an electrode one inch in diameter would enter the canal without the aid of the current.

Although more than five years has passed she is still in health with no return of the anal affection. (*Anderson.*)

Case.—Patient Mrs. W., aged 42. Rectal stricture of eight years' duration has been treated with local applications, injection, suppositories, internal medicines, and five years ago was treated with gradual dilatation by bougies for five months.

Stricture now 2½ inches from the anus, pyramidal in shape, completely circling the gut, an inch in width at base and a firm narrow top. It was complicated by numerous painful ulcers discharging muco-pus and blood. On left side were also

two firm tumors the size of the finger tip, remains of hemorrhoids treated by injection several years before.

I inserted a compound cocaine suppository before each treatment, applied a large positive felt-covered electrode to the abdomen, and used an insulated olive electrode in the rectum with the negative galvanic current.

The canal was a half inch in diameter and the first olive employed was 1/8 inch larger. It was held steadily against the stricture but without force while the current was increased gradually to 15 mil. and until the olive passed within the rectum.

It was then pushed further on and a slowly interrupted current of moderate strength was employed for five minutes to stimulate the muscles of the bowel. The interrupter was then switched out of the galvanic circuit and the constant current again employed with the original amperage while the olive was withdrawn backward through the stricture. (*Bennett.*)

The following table gives the details of four months' treatment:

Dec.	5, 1892.	Passed	5/8	olive in	5	minutes	with	15	mil.
"	8 "	"	5/8	"	3	"	"	15	"
"	12 "	"	5/8	"	1	"	"	15	"
"	15 "	"	6/8	"	4	"	"	15	"
"	19 "	"	6/8	"	2	"	"	25	"
Also negative electrolysis one hemorrhoid							"	8	"
Dec.	22, 1892.	Passed	6/8	olive in	1	minute	with	15	mil.
Jan.	9, 1893.	"	7/8	"	25	"	"	20	"
"	13 "	"	7/8	"	10	"	"	20	"
"	19 "	"	7/8	"	4	"	"	20	"
"	24 "	"	7/8	"	2	"	"	20	"
"	30 "	"	7/8	"	1	"	"	20	"
Also negative electrolysis other hemorrhoid							"	8	"
Feb.	3, 1893.	Passed	7/8	olive in	1/2	minute	with	20	mil.
"	3 "	"	8/8	"	18	"	"	20	"
"	7 "	"	8/8	"	11	"	"	20	"
"	11 "	"	8/8	"	9	"	"	20	"
"	15 "	"	8/8	"	2	"	"	20	"
"	20 "	"	8/8	"	1	"	"	20	"
"	20 "	"	9/8	"	13	"	"	20	"
"	27 "	"	9/8	"	5	"	"	20	"
Mch.	3 "	"	9/8	"	4	"	"	20	"
"	7 "	"	9/8	"	3	"	"	20	"
"	11 "	"	9/8	"	2	"	"	20	"
"	16 "	"	9/8	"	1	"	"	20	"
"	16 "	"	10/8	"	10	"	"	20	"

Rectal Ulcer.—*Negative Electrolysis.*—Moisten a felt-covered, flat electrode, about 4 × 6, in the usual hot-water solution of

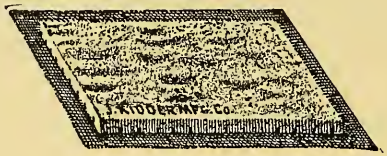


Fig. 311. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

bicarbonate of soda, connect it with the positive pole of the galvanic apparatus, and place it under the sacrum with the patient in the lithotomy position. Select any metallic electrode with an oval tip and connect it with the negative pole.

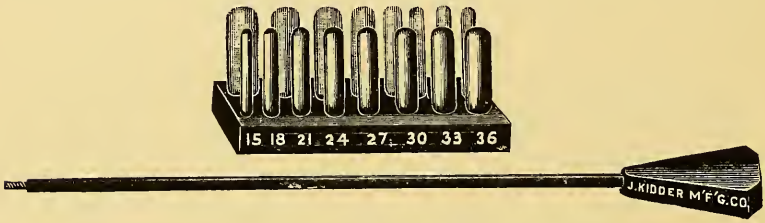


Fig. 312. Zinc—copper:—tips for metallic electrolysis.

Fig. 313. Set of olive electrodes.

Handle for same.

Expose and cleanse the surface of the ulcer, apply to it the metallic tip and increase the constant galvanic current through the rheostat from zero to about 7 mil. or just enough to accomplish a mild electrolytic action. In about five minutes reduce the current to zero. Repeat once or twice at intervals of four days if necessary.

Simple ulceration of the rectum or sigmoid will usually heal when kept clean and stimulated by the application of nitrate of silver, 15 grs. to the ounce, balsam of peru, calomel and the stearate of zinc, with iodoform, menthol or ichthyol. When the ulceration is chronic it will be necessary to either divulse or incise the sphincter and curette the ulcer. (*Surgical Notes.*)

The efficacy of mild negative galvanic currents in the treatment of almost all kinds of ulceration of any part of the body has long been well known. Always have the patient take an enema at home before presenting for rectal applications.

Peripheral Irritations. — *Rectum.*—Besides hemorrhoids there are some other pathological conditions in the rectum which are best removed by the knife. But in some cases after their removal, during the process of repair, adhesive exudations will occur preventing free action of the sphincter ani and causing pinching of the peripheral nerve filaments of this region. A reasonable time in most cases, not in all, will enable the absorbents to remove these inflammatory products.

By the aid of electricity the adhesions will be broken up and absorbed. Connect the usual rectal electrode with the

Fig. 314. Rectal electrode, bare metal.

positive pole of the induction coil apparatus and insert the metallic portion within the anus. Moisten a felt-covered, flat electrode, about 6 × 9, connect it with the negative pole and

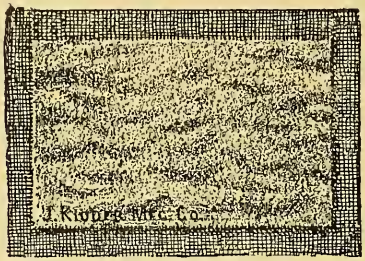


Fig. 315. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

place it under the sacrum with the patient in the dorsal position on the operating table.

Switch into circuit the rapid vibrator, four or five cells and the short secondary No. 32 or 21 wire coil according to the condition of sensitiveness. The rectum is usually very dull to sensation and will tolerate a strong current.

Gradually increase the current strength from zero until it produces a strong grasp upon the tissues, and after a few minutes complete the sitting by detaching one of the cords and with the rapid vibrator in continuous action produce the effect of a slowly interrupted current by touching the tip of the cord to the terminal post of the battery twenty or thirty times a minute. This will produce alternate contraction and relaxation of the muscles and gradually break up adhesions and hasten the absorption of inflammatory products if they are recent. In chronic cases the negative galvanic current should be employed within the rectum as described in the treatment of rectal stricture.

In employing the faradic current it is well to use a smaller rectal electrode in the latter half of the course of treatment so that more complete contraction and exercise of the anal muscles can be secured.

Speaking of the impaired condition remaining after operation, the results from the removal of the hemorrhoids being

unfavorable, I had an experience of this sort in the Worcester City Hospital last summer. The case had two very severe hemorrhoids removed, and stricture from plastic adhesions resulted. The case remained in the hospital nearly six weeks with no apparent improvement. Then the surgeon requested me to try the electric current. I used a low intensity faradic current, placing the positive pole in the anus and using a rapid break current. I followed the case up for about eight weeks, and at that time the gentleman was restored to perfect health, all pain had subsided, and the action of the sphincter had returned to the normal condition. I had an experience in the army with chronic diarrhœa which is interesting. I had been detached from my regiment and assigned to the ambulance corps. This case was that of a cavalryman whose original weight was 150 pounds, reduced to 90 by the disease. Apparently there was an ulcer high up in the rectum. I took the field telegraph apparatus, used a pair of bullet forceps insulated as well as possible with cotton cloth, and passed them into the rectum about four inches. I placed the positive pole at the second cervical vertebra and passed the current for fifteen or twenty minutes at a time. I used the telegraph key as alternator. At the end of three months he was discharged cured. (*Flinn.*)

Prolapsus Ani.—Probably all but very old and complicated cases of this condition can be wholly or partly relieved by the muscle-toning action of coil currents. Prescribe remedies to improve the usual constipation also. The following case occurring in the author's clinic illustrates the method. In a more aggravated case the patient was treated successfully in two weeks.

Bridget G., age 50, married, four children, deaf in right ear, very anæmic and neurotic. Among other troubles she suffers from prolapse of the rectum, and has been unable to enjoy a comfortable stool in some years. The tissues were not indurated and thickened, and she was relieved in three treatments. A felt-covered, flat electrode was placed under the sacrum, with patient in dorsal position on operating table. Electrode connected with negative pole of coil apparatus. An ordinary rectal electrode was inserted in rectum and connected with the positive pole. Rapid vibrator, four cells and 100-yard No. 16 wire coil were switched into circuit. As soon as current strength was regulated to agreeable tolerance slow interrup-

tions were made by touching a cord tip to one of the terminal posts. This method produces a very different action upon muscle tissue from the action of the usual slow vibrator interruptions. Length of sitting, ten minutes. No prolapse after first treatment. Felt a general benefit, which she was disposed to magnify.

CHAPTER XXXVII.

SPECIAL THERAPEUTIC METHODS.

The electric light as a therapeutic agent. Therapeutic properties of X-rays. Sinusoidal currents. Cataphoresis. Metallic electrolysis. Zinc-amalgam electrolysis. Thermo-electric currents. Electric water-bath. The electric douche. The electro-therapeutic cabinet bath. Central galvanization and general faradization.

THE physician who first attempts to instruct himself upon the subject of electro-therapeutics is often more or less bewildered and dismayed by the apparently endless variety of currents, methods and variations of methods which he finds mentioned in the text books he consults.

I am repeatedly asked for information about the actual or comparative value of some of these methods. It will render a service to many physicians to state in a few words the comparative value of some of the chief methods of treatment described or advocated by different writers. My own belief is that in the galvanic, faradic and static currents from the best of improved, up-to-date apparatus the practitioner has at command all that is best in medical electro-therapeutics. Beyond these is the cautery battery for surgical uses, but no other form of apparatus is either indispensable or superior to the three standard types as now made.

A medical journal which is the exponent of a great surgical school contains the following paragraph in its current issue:

"It is a very mistaken idea to suppose that there were no good physicians and skilful surgeons before the days of antitoxine and antiseptic surgery. A great deal of the world's progress is simply in a circle." This remark applies to medical electricity. Complicated and difficult methods are not necessarily better than simple methods. In clinical practice I

always aim to use the simplest and easiest method that will do the work, and have pursued the same plan in writing this book. Others may elaborate technique after acquiring the basic principles of current action.

The Electric Light as a Therapeutic Agent.—Anodyne and other therapeutic effects have been attributed to the incandescent electric light. Journal articles have stated from time to time that the electric light has been employed successfully for the cure of diseases of a catarrhal, scrofulous or syphilitic nature; for disorders engendered by atmospheric conditions, la grippe, pneumonia, rheumatism and for tainted conditions of the blood. It has decided effects in removing effete and poisonous material from the circulation, making the glands active in eliminating, and thereby enabling the body to resume its functions normally. Under the constitutional treatment the patient begins to perspire profusely, thus sending the noxious material through the pores and freeing the body from its further contamination.

As long ago as 1890 Stein reported a series of fourteen cases of various painful affections in which he used electric light as an anodyne with almost "magical" results.

The apparatus (devised by himself) used for the purpose consisted of a small-sized (three or four volts) incandescent electric lamp, furnished with a suitable handle and a funnel-shaped reflector, varying from 3.5 to 6 centimetres in length and from 2 to 3 in the longest diameter, the lamp being fixed within the reflector. In cases where the head or neck was affected, the illumination (the reflector being applied directly to the painful area) lasted from ten to fifteen seconds; in other regions of the body from one to five minutes, or even longer, until the patient began to complain of intense heat. The anodyne effects are said to have been invariably most striking. A woman, suffering from very obstinate intercostal neuralgia, after a single sitting (a series of illuminations, each of a few seconds' duration), was completely and permanently freed from pain. The same result was obtained from another patient suffering from intense rheumatic pains about the shoulder. In a woman, aged fifty, suffering from agonizing lumbago, four sittings of five minutes' duration twice a day proved equally

successful. In another patient, a nervous woman, who had had excruciating pain about the right foot and ankle causing lameness, two illuminations of five minutes' duration caused complete cessation of the symptoms. In a patient suffering from pulmonary and laryngeal tuberculosis, and most troublesome, almost incessant cough, in which even morphine in the daily dose of one grain had afforded but trifling relief, from ten to fifteen seconds' illumination of the larynx and both sides of the neck externally, repeated every other day, reduced the paroxysms of coughing to two or three in the twenty-four hours. (*Brit. Med. Jour.*)

The incandescent lamp has been applied to neuralgic pains something in the same manner as the hot-water bag. The lamp is wrapped with one or two thicknesses of protecting material turned towards the patient's clothing so as to prevent scorching it and sufficient paper on the outside to enable one to handle it easily. The time required for each application is from three to ten minutes. In chronic cases frequent applications are required.

The local uses of the lamp bulb resemble most nearly some of the simpler uses of the galvanic current. The effects combine the action of heat and electrical discharge and probably some form of radiant heat rays which penetrate into the tissues. Roentgen's discovery of X-rays has removed a great deal of the former mystery which hovered about this subject, and the phenomena of the action of electric currents within vacuum bulbs are now better understood.

It may be said however that the therapeutic action of the three great currents, galvanic, faradic and static, obtained from improved apparatus, cover the range of practical medical electricity and that the electric light does not add anything to them.

In a single other form of use we find the electric light associated (as is the thermo-electric current) with a cabinet bath apparatus, and in this way producing effects which are at least interesting if not more of a luxury than a necessity.

The physiological effects of the radiant heat bath are chiefly

those of heat. The bath is simply a cabinet or box containing a number of incandescent lamp bulbs which are the source of radiant heat rays which penetrate the tissues and produce perspiration without increasing the temperature of the air in the cabinet above that of the body. Its effects are tonic. These tonic effects may be further intensified by following the bath with a cold spray. The incandescent electric light is considered much superior to the arc light for therapeutic applications. The action may be localized upon various parts of the body either by separate and local applications or by covering other portions of the body with a protecting garment

The general utility of the apparatus covers sedative-tonic and nutritional actions *common to the uses of other forms of electrical apparatus in general use.* The static machine performs a great deal of the same work in a more practical way and is suited to office practice, while the radiant heat bath is not. Reflection upon the matter and clinical experience confirms the belief that the usual medical currents from high-efficiency apparatus constitute a complete armamentarium and that variations from these add nothing substantial to electro-therapeutic resources and are non-essential to the practitioner.

Therapeutic Properties of X-Rays.—At an early period of scientific inquiry into the nature of X-rays, and especially when it was found that their most practical application was to aid the surgeon in diagnosis, it was inferred that they might possess therapeutic properties.

This phase of their action may well be one of interest to the medical mind, and for more than a year I have carefully followed the various reports upon the subject. These reports chiefly relate to laboratory tests upon microbe cultures, and represent the least reliable side of medicine to-day. Bacteriology is, except in rare instances, the most unsafe guide that clinical therapeutics can attempt to follow, and to the practical student of medical electricity it seems impossible to discover any serious basis for regarding X-rays as curative agents.

Few, if any, suggestions of medical properties have come

from leaders in electro-therapy. My own conclusion is that X-rays do not possess any particular therapeutic properties; that alleged actions upon disease germs result from the electrical current employed and other natural causes; and that any possible actions that may reside within the X-rays themselves are already at our command in the established procedures of galvanic, induction coil and static medical currents.

No other view seems to me at all tenable. All that is claimed by sensational exponents of X-ray therapeutics seems very commonplace and familiar to the trained electro-therapeutist. Roentgen's report has stood the closest examination and is to-day one of the masterpieces of exact statement. Those who jump at conclusions before reading it find afterwards that the original discoverer very thoroughly cleared the ground before he gave his message to the world.

From the study of Roentgen's report, upon which there has been no great scientific advance, and from the consideration of electro-physical, physiological and therapeutic effects, it seems impossible to seriously consider any medical relation of X-rays to disease separate from the action of the current which excites them. Their excitation within a Crookes tube is associated with three types of current—induction coil, high-frequency coil and static—and all the therapeutic properties of these currents have been fully available to medicine for a number of years. From time to time there springs up some minor innovation upon the chief varieties of electro-medical currents; but in the author's opinion—here very confidently expressed—the physician who possesses a proper galvanic battery, high-tension induction coil apparatus and large Holtz machine can cover the range of all the non-surgical applications of electricity to the treatment of human disease.

If the X-ray possessed any or all of the properties which bacteriologists have been attempting to discover within it, nothing would be added to the present resources of medical electricity.

Sinusoidal Currents.—The place of the sinusoidal alternat-

ing current apparatus in the physician's office may be fairly regarded as midway between that of the common and crude faradic battery, and the complete, improved, high-tension induction coil apparatus. It is superior to the former, and the possession of the latter renders it practically superfluous.

Its superiority over crude faradic coils is about proportioned to its greater cost, and it has been warmly praised by those who contrast it with the inferior device. It is easy to understand that the finer sinusoidal appliance may well inspire enthusiasm in the practitioner whose faradic battery is of an unsatisfactory type, whether new or old, but it can only in part parallel and never surpass in quality, or equal in variety and degree, the great range of dosage and diversity of application of the best high-efficiency induction coils and currents from the static machine. To the fortunate possessor of these electro-therapeutic essentials the sinusoidal current offers no additional clinical advantage. It requires the removal of clothing and the same methods employed with faradic currents.

It is a beautiful apparatus and provides a current which is wonderful in kind. The alternations may be pushed to a maximum of 115,000 per minute, but there is no therapeutic advantage in this. The marked limitations of the current are due to two facts stated by the manufacturers:

1. The motor and sensory effects are equally developed at each pole and this current lacks the advantage of high-tension coil currents with distinct polarity. It is also not portable.

2. "The E. M. F. at the secondary terminal usually falls to less than 20 volts under the conditions of ordinary applications and external resistance." High-tension induction coils under similar conditions cover a very much wider range of voltage than this, and static currents go immensely higher.

Cataphoresis.—For a number of years all physicians who have been interested in electro-therapeutics have known that practically any solution, or medicine in a form which galvanic electrolytic action would decompose and make soluble, can be

driven into the tissues to a limited extent by the cataphoric (or osmotic) action of galvanic currents of medium amperage.

Fig. 316. Reservoir cataphoric electrode.

The possibilities of making local applications in this way have been fully demonstrated. Ingenious methods have been devised for localizing and confining the action to affected tissues, and medicines have also been diffused into the circulation for their constitutional effects.

Experimental work has demonstrated about the full capabilities of cataphoric medication. There is little more to learn about it. In the hands of a physician who employs only a galvanic battery the additional effects which can be obtained by pushing a drug into diseased parts are sometimes practical and important. They cease to be practical and important in direct ratio to the completeness of the electro-medical equipment, and when the operator possesses all the resources of induction coil and static currents as well as the galvanic current there remain but few uses for cataphoric medication. In skin affections cataphoresis with a 1 to 1.000 bichloride of mercury solution is valuable and is noticed by the author in each appropriate place. The pain-obtunding properties of cocaine and eucaine solutions usually injected into the tissues through a hypodermic needle may be diffused through the skin by cataphoresis. Sometimes the action of iodine also aids the alterative action of the current alone, but the uses of lithium in rheumatism and the majority of the large number of possible cataphoric applications add nothing to the results of less troublesome methods and are therefore without practical value.

In saying this I do not refer to what is known as metallic electrolysis but simply to the diffusion of ordinary drugs into

the skin and tissues by the push of the galvanic current. It has been my experience that it is rarely necessary to resort to the cataphoric method, and it is still more rare to obtain effects which some form of electrical current will not produce by ordinary administration. As a number of writers have reported experimental cataphoric work under a variety of titles it is unnecessary to do more in this place than to state the comparative value of the method. There is of course no objection to employing it in every case in which it can be made of service. I simply state it as my own experience that other methods generally equal or supersede it in value and render its uses limited to special occasions. In every case in which any form of cataphoric medication is considered important by the author the manner of making the application will be described in connection with the disease so that no general directions need be repeated here.

Metallic Electrolysis.—The application of medicinal salts of metals to inflamed mucous surfaces is a very familiar practice. In the form of solutions the same or similar salts are astringent, antiseptic, sedative or stimulating according to use. In concentrated form some of practically the same salts are applied to mucous membranes as caustics and alteratives. Salts of mercury, zinc, copper and silver are among those commonly employed in topical applications. When, however, a stick of sulphate of copper is swept over an inflamed conjunctiva it is a purely surface application, and dilute solutions injected into the cavities do not act much below the mucous surface.

In many cases it would manifestly be desirable to set up deeper antiseptic or alterative action if the absorption of the drug would not produce poisonous effects. This deeper action is secured with perfect and adequate control of localization and intensity by applying the same metals—mercury, zinc, copper and silver—by chemical decomposition.

A pure metal electrode is employed; the positive galvanic current collects acid fluids from the tissues and decomposes a

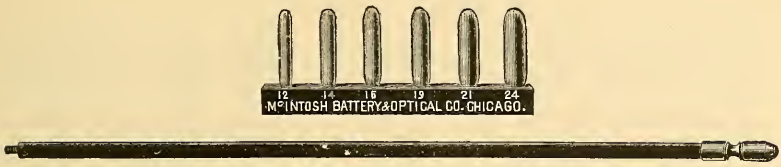


Fig. 317.

small part of the metal. A new formation of an oxy-chloride salt in a soluble state takes place. As fast as the salt is formed it is diffused upon and within the tissues in contact with the metallic surface of the electrode by the combined electrolytic, cataphoric and osmotic action of the current. The activity of the process is proportioned to the current strength, and it can therefore be regulated with practical exactness by the operator. The advantages are:

1. The local actions of these valuable metallic salts are obtained in the most thorough and effective manner.

2. Valuable actions of the galvanic current are added to and enhance the effects of these active salts.

3. The application is essentially aseptic and antiseptic.

4. There is no caustic action or destructive cauterization of the tissues.

5. No deleterious effects from absorption of the metals occur.

6. The complex action of metallic electrolysis possesses a greater therapeutic value than either the metallic salts or the current alone in the treatment of conditions to which this method is suited.

Many metals have been tested clinically, but the general practitioner will require to use only the electrodes now regularly made by all dealers—copper, zinc and silver. The method of

Fig. 318. Set of copper, zinc and silver eye electrodes, insulated on back.

using any size, shape or variety of these electrodes is the same in principle. The mucous membranes of the eye, nose, throat, urethra, uterus and rectum which are the site of catarrhal inflammation of any stage or degree form the therapeutic arena of metallic electrolysis.

The negative electrode is any ordinary felt or sponge covered pad large enough to make the current density comfortable. It is applied to some convenient part near the tissues which

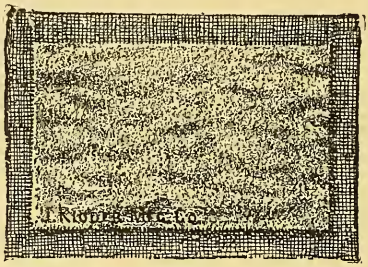


Fig. 319. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

are about to be treated by metallic electrolysis. The selected metallic electrode is then fixed upon its insulated handle, connected with the positive galvanic pole, and thoroughly brightened with the finest emery paper before using. This cleansing of the surface must be repeated immediately before each and every application.

Extremely sensitive parts such as the eye, the nasal cavity and the pharynx should be protected from pain by a eucaine or cocaine solution. When all is ready the metallic bulb or sound is applied to the part and the constant galvanic current increased through a rheostat from zero to the required dosage.

The duration of *séances* ranges from one to ten minutes—rarely more—repeated at intervals of from four to six days. When the application is made to an already inflamed surface some additional irritation is set up (especially by the salts of copper), and this is allowed to subside before another sitting.

During the passage of the current the copper electrode will

become adherent to the tissues in contact with it if it remains stationary. In all minor applications with small contacts such as are usually made in the eye, nose, throat and rectum, this

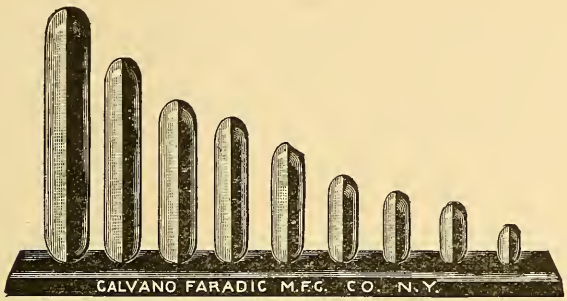


Fig. 320. Set of semi-insulated bulbs for metallic electrolysis.

adhesion is avoided by keeping the metallic tip in slight motion over the surface. The object of preventing adhesion is simply to permit the withdrawal of the electrode at the close of treatment without tearing it forcibly away from delicate tissues and doing them injury by violence. The mere fact of adhesion would otherwise be a matter of no consequence.

When a sound electrode is applied in the urethra or uterine

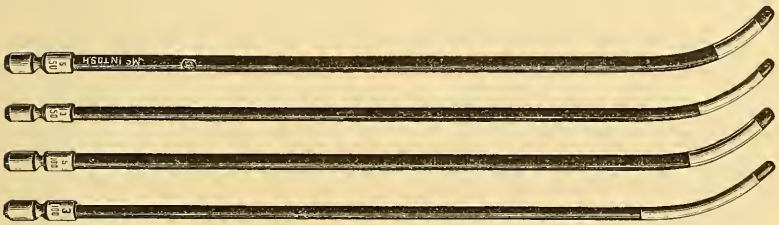


Fig. 321.

cavity it can either be gently rotated to keep it from sticking fast or it can be held stationary during the *séance* and loosened for withdrawal by reducing the current to zero and reversing it to secure the dilating and softening action of negative electrolysis. This is the usual method.

Extreme gentleness is necessary. No physician should

attempt to employ this method upon patients without first familiarizing himself with the effects of different doses from 1 to 30 mil., with different metals applied for different lengths of time.

Zinc electrodes do not irritate so much nor stick so fast to the tissues as do copper. Silver is also less irritating. If a zinc electrode is amalgamated with mercury it does not adhere at all, and produces practically no irritation. (See ZINC-AMALGAM ELECTROLYSIS.)

The experienced operator acquires in practice the habit of using either copper or zinc according to his own preference. It was formerly taught that copper was the best for soft, vascular and spongy conditions, while zinc was more especially indicated in conditions of sclerosis. The fact however that very nearly similar effects can be produced by either of these metals is sufficient to prove that the operator may follow his own clinical experience with safety.

Metallic or interstitial electrolysis, as an important therapeutic method, was developed by Gautier, of Paris, beginning about 1892. He has continued to advocate the method. In regard to the action of cupric electrolysis in hemorrhage Gautier states:

"I maintain that the method is the best treatment against hemorrhage. After the sitting we have often a slight flow of blood, even for two or four days, but afterward the effects of the treatment appear, the congestion is diminished and the vascular tissues are contracted. Thus in chronic metritis, characterized by hyperplasia of the uterine connective tissue with an increase of sensibility, we can verify after one sitting of cupric electrolysis the most marked improvement. The menstrual flow is subsequently diminished, the sensibility disappears and the patient is greatly relieved. These post-operative actions are easy to study in external applications. In sycosis for instance the lips are swollen the first day; on the second large, greenish, serous patches are seen at the site of puncture; after that the skin becomes normal in color and very supple. But the treatment of external hemorrhoids shows most clearly the effects of the oxide-chloride of copper. When we puncture a large hemorrhoid, the same evening the veins

are dilated and swollen, the third day they are scarcely visible. In this case also there is a slight flow of blood, but this is of slight importance as the hemorrhoid so treated remains permanently cured."

The value of this method of combining the action of the positive galvanic current in moderate dosage with the action of copper, zinc, mercury and silver is considerable. It sometimes enables us to treat successfully catarrhal inflammations and purulent conditions which no electric current attacks so successfully alone. In order that the physician who has read but little upon the subject may be informed of statements made by leading operators in regard to effects which they obtain with this method I will next collect together selected extracts from various sources.

"Cupric electrolysis is particularly advisable in cases of septic endometritis where for any reason it is considered unadvisable to curette. I have had a number of cases where septic endometritis has been overcome by half a dozen applications or less. I recall particularly a case of distinctly gonorrhœal origin which was completely cured by six applications of this kind. The case has been kept under observation for many months so as to be sure of the permanency of the result. Another application of cupric electrolysis is the treatment of vulvo-vaginal cysts after evacuation of the contents of the cyst. These cysts are obstinate in healing under the usual treatment, but under cupric electrolysis with a current of from 20 to 25 mil. for five minutes one or two applications usually suffice to effect a cure."

"In endometritis, associated with dysmenorrhœa, I have in three or four treatments given complete relief. I am more inclined to use zinc than formerly, particularly in cases of erosion. I have treated trachoma in the third stage by means of zinc electrolysis, and the improvement has been very marked and permanent although only a few applications have been given. I continue to use cupric electrolysis in atrophic rhinitis with success, also in follicular pharyngitis. In several cases of acute follicular tonsilitis a single application of cupric electrolysis, three to ten mil., has resulted in complete resolution. In an epithelioma, with extensive ulceration, two applications of cupric electrolysis gave relief from symptoms and a tendency of the ulcerated surface to heal from margins and

bottom, but the case was not followed up. In a case of beginning suppuration in a nurse's finger from infection a cupric puncture with 2 to 3 mil. established resolution. In specific urethritis in the female I continue to find it prompt and efficient in action."

"I wish to report a case of mucous cysts of the tongue occurring in a patient 25 years of age. The tumor was about the size of a hen's egg. It had been operated upon once in Germany and several times in this country, so far as could be ascertained, by evacuating the cyst and injecting iodine and similar remedies. I evacuated the cyst and made two applications of cupric electrolysis about five days apart. The result was a perfect and permanent cure."

"My experience with metallic electrolysis has been chiefly in treating inflammations of the surface membrane, in endometritis and in gonorrhœa, and in these cases there is a wide field for its action. In almost all the applications of local remedies hitherto made the albumen of the tissues has been coagulated by the application, and the bacteria in this way shut off as it were from the effect of further application. On the contrary, by metallic electrolysis, we are able to ferret them out and destroy them. I have never found anything so satisfactory for the treatment of gonorrhœa, and my assistant has reported that she obtains remarkably good results in dysmenorrhœa."

"Uterine hemorrhage, endometritis, urethritis and ulcerating surfaces are some of the uses to which metallic electrolysis can be put. It has been employed quite satisfactorily in hemorrhoids and ulcers of the rectum, using from 10 to 25 mil. for five or ten minutes. In hemorrhoids, though applied to the surface, the tumor shrivels up and gradually subsides. In some instances the tumor has been punctured with copper needles with very encouraging results. I have employed

Fig. 322. Needle with adjustable sheath for puncture metallic electrolysis.

cupric electrolysis extensively in the treatment of hemorrhage from the uterus and in endometritis, and have been very well satisfied with the results. In uncomplicated uterine hemorrhage it has no equal, and in endometritis associated with a softened and relaxed condition of the uterine body the results have been excellent."

"It is quite important however to be certain that the cervical canal is patulous for subsequent drainage, and this part of the canal should be excluded from the action when possible to avoid uterine colic, which may occur when this precaution is not observed. I am in the habit of employing from 20 to 30 mil. for five or ten minutes for the control of uterine hemorrhage, and it will control the bleeding when every other means has failed.

"I have used cupric electrolysis also with great satisfaction in fissure of the anus, using from 10 to 15 mil. for three to five minutes only. Healing has been accomplished in this manner after only two, or at most three, applications without stretching the sphincter. In proctitis there is nothing equal to it. Here a strength of 10 to 20 mil. is used, and the electrode is kept in motion so that the whole surface may be submitted to the action. In ulcer of the rectum this method of treatment likewise yields excellent results. Here the surface may be exposed with a speculum and the action localized where desired.

"I have also applied metallic electrolysis to the cavity of vulvo-vaginal cysts after evacuation, and have thus promptly arrested the secretion and effected rapid healing. It may be utilized in the same manner in the treatment of other cysts also. I consider that the greatest value of zinc electrolysis is in the treatment of endometritis associated with a condition of sclerosis of the uterus and in granulation, or so-called ulceration of the cervix. I know of no other method of dealing with this condition of granular degeneration of the cervix which will give anything like the prompt result that this will. In a case last treated complete healing of the surface was effected by six applications."

Zinc-amalgam Electrolysis.—The electrode for this purpose is prepared in the following manner: Freshly brighten the surface of the zinc tip or sound, selected for a given case, dip it in a vial of dilute sulphuric acid, or strong vinegar to which ten per cent. of commercial sulphuric acid is added. Next pass the electrode through water to remove the excess of acid and dip it into a vial of crude mercury. Rub the quicksilver well over the entire zinc surface and the electrode is ready for use.

It is always employed with the positive galvanic current, and in the same manner as all other administrations of *metallic electrolysis*. The negative electrode is always a large flat pad

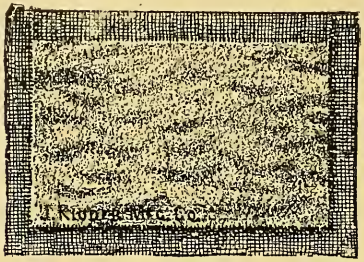


Fig. 323. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

covered with any of the usual materials and saturated in a hot-water solution of bicarbonate of soda, about a dram to the pint.

The surface of the amalgamated zinc electrode is slowly consumed in the electrolytic process, carrying a mixed infiltration of zinc and mercury into the adjacent tissues.

The antiseptic and medicinal value of the procedure is self-evident. The surface of this electrode is lubricated and is easily inserted into the uterine canal. It does not adhere to the tissues and avoids the necessity of reversing the current in order to withdraw it. It produces little or none of the irritation so marked in cupric electrolysis. It has been employed in malignant degenerations (the odors of which it destroys) and in purulent and muco-purulent inflammations of the uterine membrane, in which cases it has at times given better results than the galvanic current alone.

Thermo-electric Currents.—The term *thermo-electric* is very familiar to physicians, but thermo-electric batteries have no practical place in the office equipment of the practitioner. The current which is produced by employing opposite temperatures instead of chemical action is at best but an unhandy and inferior substitute for the galvanic current which is obtained from convenient and controllable apparatus. There is however one therapeutic employment of thermo-electricity of sufficient importance to note. It is in connection with a cabinet bath apparatus.

The most expensive and celebrated type of thermo-electric bath is to be found in a number of bath establishments throughout this country. A well-known sanatorium advertises the action of this bath in the following manner:

As a means of equalizing the circulation and of eliminating waste and poisonous matters from the body and increasing general metabolism, it is considered superior to even the Turkish or Russian, which also are employed at the Sanatorium. Thus an opportunity for comparison of effects is given. In catarrhal conditions of the respiratory tract, as in acute or chronic bronchitis, in la grippe, etc., it has often proved of great value. In congestion of liver, or catarrhal inflammation of the digestive tract, the ease with which the skin is surcharged with blood proves of great relief to the internal organs. In acute or chronic rheumatism and gout it is particularly valuable. In dropsy due to heart lesions it is very serviceable. Reduction of water in the abdomen and limbs in these cases is oftentimes very marked, the œdema disappearing rapidly. The bath can be given with perfect impunity in the most serious cases of valvular disease with dilatation. Experience with the bath, in Bright's disease particularly, has shown it superior to all other methods for relieving the kidneys and reducing general œdema. Some remarkable cases have been under observation along this line in the history of the Institution. As a means of eliminating nicotine in persons suffering from excessive use of tobacco, nothing better has been found. In cases of neurasthenia dependent upon imperfect nutrition, either assimilative or disassimilative in character, the Molière-thermo-electric bath often proves wonderfully stimulating to the vital forces, combining as it does the good effects of perspiration with the tonic influence of the cool spray afterward. It has been found most useful in reducing superfluous flesh, and when combined with thorough massage in these cases is the most effective agent in the experience of the Institution in supplementing a proper diet for rapid reduction of obesity.

I am unable to appreciate the therapeutic superiority of this costly apparatus so far as its effects refer to electrical action. In the less expensive cabinet which I employ myself the bath part of the treatment can be adjusted to cover the practical range of any cabinet apparatus. Moreover I am able to employ and control as desired for either local or general effects the galvanic (constant or interrupted) and induction

current (all varieties of coils with all rates of interruption) and regulate the dosage to suit each particular case. The two currents can also be combined and employed together. Inasmuch as the therapeutic capabilities of these currents greatly exceed the small range of therapeutic action which can be attributed to the feeble thermo-electric current it seems to me that the ordinary apparatus is really able to do a greater variety of work.

In this judgment I am supported by the opinion of a medical gentleman who was for years connected with an establishment containing both types of apparatus. His experience covered 27,000 baths, and he has repeatedly informed me that the electro-therapeutic cabinet bath to which I refer was practically equal to the celebrated Molière.

There is no ordinary employment of thermo-electric currents which need concern the physician in private practice.

Electric Water-baths.—As electric baths are given in commercial institutions they are mostly limited in their effects to a general tonic action. The relative value of electric baths in therapeutics depends upon how the particular bath is administered and the state of the patient. The warm-water bath slightly increases the activity of the circulation and somewhat retards tissue metamorphosis. It is a valuable soothing agent, but in other respects the water in the bath acts chiefly or only as a means of conducting the dosage of the particular electric current employed.

This at once defines the therapeutic work which can be accomplished by electric baths. As galvanic and faradic currents are both employed a study of the physiological effects which they can be caused to produce (see Chapters V. and VIII.) will inform the reader on this point. Owing to the limitations in regard to technique electric baths practically resolve themselves into little more than general tonic administrations, and as a matter of fact the water-bath is very much inferior to the cabinet bath in which the same currents can be employed to better advantage.

The chief author known to me who has written upon the subject of electric water-baths from a scientific standpoint says, in one of his most recent articles:

The patient who finds it necessary to undergo a course of electric baths has not generally any considerable resisting power to cold; he is moreover often nervous or hyper-sensitive. Therefore if stimulation either by cold affusion or by the electrized douche be attempted it is obvious that the operator must have his apparatus well in hand. It is scarcely too much to say that the success of the electric douche depends upon the easy graduation and the perfect controllability of its hydriatic strength. A quarter of an hour's rest is taken, and weather and strength permitting the patient walks at least part of the distance home. In administering a bath to paralyzed, anæsthetic and other helpless people special precautions must be taken, especially if a patient be heavy as well as helpless. In all such cases the greatest care must be exercised not only in placing the patient in the bath, but in looking for wounds, ulcerated surfaces, skin abrasions, etc., and protecting them from the action of the current. Before being placed in the bath the condition of the patient's "sensibility" (tactile-pain-temperature-muscular sense) must be carefully inquired into. Serious ill effects have followed the administration of electric baths by incompetent persons whose only limit to dosage is what the patient will bear.

An average "course" of baths extends over about three weeks. Speaking broadly, the painless and evenly distributed current of the electric bath makes it one of the best methods of general electrization with at the same time a considerable power of concentration on special parts. In all states of general debility and impaired nutrition, in weakness or exhaustion of the spinal nervous system, nervous dyspepsia, palpitation, hysteria, neurasthenia and many of those diseases referable to some derangement of the nervous system without appreciable lesion (commonly called neuroses) it may be resorted to with excellent results. Neuralgias, sciatica, paralysis both of central and peripheral origin, chorea, primary lateral sclerosis, muscular rheumatism, gout, rheumatoid arthritis and occasionally chronic articular rheumatism, are all recorded to have been cured or alleviated by its use. It is said to have been used with good effects in some irritative conditions of the spinal cord, in alcoholic or mercurial tremors, plumbism, and even paralysis agitans and peripheral neuritis from whatever cause though not perhaps in every stage.

The author's experiences with this treatment may be summarized thus:

Muscular rheumatism, frequent and rapid cures—not superior however to other electrical methods.

Chronic articular rheumatism—results on the whole disappointing.

Gout—often improved after a course of baths in suitable cases, but being generally combined with other remedies and always with dieting the exact relationship of cause and effect becomes comparatively obscure.

Sciatica—good results, not superior to alternating current.

Urethral synovitis—only yields to these baths when the disease has continued for some time and is probably waning in the ordinary course of events.

Locomotor ataxia—occasional alleviation in symptoms, but not always easy to separate results from those periods of arrest which usually characterize the disease. Not all cases suitable.

Chorea—ordinary cases sometimes get rapidly well under a course of these baths as they do after any other form of treatment, or after no treatment at all, but that comparatively small class of cases which not only resist rest and arsenic, and known as relapsing chorea, have been treated with only temporary benefit, lasting perhaps only for a few hours, seldom with a permanent success.

Amenorrhœa—a current localized between the lateral and gluteal electrodes as in several instances is found quickly successful.

Among the rare cases one of melancholia and one of hysterical paralysis have been greatly improved; in the insomnia of neurasthenia this form of bath has been found useful as a beginning of electrical treatment.

Those rarer uses of the constant current bath consisting of the introduction of medicinal substances or the elimination of metallic impurities must be considered. The latter is demonstrable and certain.

To carry out the process in the case of plumbism a little sulphuric acid is added to the water of the bath into which a large copper plate connected with the negative pole of the battery is introduced. The patient then grasps the positive electrode outside of the water and the current is gradually turned on. The lead from the patient's tissues becomes deposited on the copper plate according to the law well known to electroplaters. For metals other than lead nitric acid takes the place of the sulphuric. (*Hedley.*)

While the water-bath may be employed to conduct electric

currents into a patient in institutions which are fully equipped for this purpose, yet the perusal of the above statement of its practical work discloses the absence of original or unique effects which cannot be produced more easily in other ways. The electric bath of this character is not only impossible in office practice but it performs no work which cannot be done in office practice by the three great varieties of ordinary apparatus, the galvanic, faradic and static.

The chief claim that can be made for the bath is in the line of general electrization. In this respect it is inferior to a variety of methods, and to the therapeutic effects within the scope of the static machine.

If there is a single effect in which the bath might be supposed to render unique services it is in the elimination of metallic poisons, and perhaps in respect to mere elimination it is superior to other measures. But there remains the paralysis and muscular atrophy still requiring treatment. The reader who will turn to the author's manual of static electricity in X-ray and therapeutic uses will find on pages 513–515, 548–552, evidence that treatment by static electricity and the internal administration of potassium iodide will accomplish effective results without any of the trouble of disrobing and with one-fourth of the time and trouble of the electric bath in ordinary cases.

The reader who peruses the general range of therapeutic action of the electric bath as cited above from Hedley's paper has only to turn to the demonstrated physiological and therapeutic actions of static electricity and its simpler methods of administration to see that without in any way detracting from any merits which the electric bath may possess we have no occasion to resort to it in practical electro-therapeutics. Its employment in a sanatorium is a matter of choice based usually upon business reasons. The inconveniences attending the administration place these baths entirely outside the conditions of ordinary practice, while the electric currents upon which the baths depend for their therapeutic action are at the command

of the operator in his own office, and will produce the same results by simpler methods of technique. The fact that charges of quackery and empiricism have been levelled against the electric bath has nothing to do with the case. Quacks use drugs, surgical instruments, the hypodermic needle, massage and even X-rays. Dry good stores sell quinine, iron, cod liver oil and tonics, etc., *ad lib.* The world of medicine is open and free, and the intrinsic merit of any remedy is neither increased nor diminished by the improper uses which may be made of it by others. We are concerned only with the merits of the electric bath as its value is demonstrated by scientific medical observers in extensive institution work.

The Electric Douche.—Another device which combines water and an electric current is called the *electric douche.* It has been stated to be a therapeutic expedient of undoubted promise. An unbroken stream of water will of course conduct a current of electricity. Hedley states: "The electrized water-bath possesses many unique advantages as a means of applying electricity to the body. That it is the best form of application for a certain class of cases is very generally admitted. It is of all other methods the one that best deserves the name of 'general electrization.'"

When we consider the disrobing, the exposure and the inconvenient technique of dashing water upon a patient through a nozzle which is connected with a galvanic battery and carrying a current of from 5 to 25 milliamperes we think it requires considerable hardihood to ignore the immense superiority of the convenient and practical static apparatus as a means of general electrization and argue in favor of the electric douche. The one is among the most useful instruments that can be employed in office practice, the other is impossible in an office and is inferior anywhere.

The Electro-therapeutic Cabinet Bath.—The employment of medical electricity and the recognition of the effects of the different currents in their complex relation to the human tissues tends I think to broaden the mind of the practitioner, and

we fall into the habit of treating the patient rather than treating a diagnosis.

It cannot be said that the application of an "electric bath" is especially indicated in the treatment of any *disease*. There has been much discussion pro and con about the merits of electric baths, but criticism has been levelled for the most part at the tub water-bath into which a couple of electrodes are often dropped for revenue only.

The nearest approach to a practical, useful and therapeutic form of electric bath known to me is a cabinet in which dry or moist heat or medicated solutions can be employed together with galvanic and faradic currents applied in exactly the same way as outside of the bath. This apparatus is the least inconvenient and the most practical form of electric bath that can be employed in a hospital, sanatorium or physician's house. It is obviously not an apparatus for office practice and is never an indispensable necessity, for I do not believe that it is possible to point to a single effect which can be produced by electric currents during a bath of any kind which cannot be produced in ordinary practice by some of the resources of galvanic, faradic and static electricity. Nevertheless the bath cabinet is a very valuable apparatus and cannot be spared from the equipment of a sanitarium.

Simple perspiration is a decided factor of benefit in the cabinet bath, both both because it performs an eliminating function and because it increases the conductivity of the skin, while in the tub-bath the skin is simply soaked in the surrounding water. There are other important matters of difference to consider. A couple of years ago I wrote a reply to an Australian inquiry about the therapeutic action of electric baths from which the following extract is taken :

The subject is important enough to be thoroughly answered, and inasmuch as I can speak from personal experience I will state the facts about electric baths. The term is indirect and expresses nothing definite. Let us therefore discard it and simply consider the matter of applying a proper therapeutic

dose of either the constant galvanic current, the interrupted galvanic current or any one of the variety of faradic currents, to any given case of disease, with the patient meanwhile placed in a tub of water. This reduces the merits of the inquiry to a very simple form, for if it is conceded that the passage of the various electric currents through the tissues is attended with definite physiological effects *the situation of the patient* during the actual passage of said currents in proper therapeutic doses *cannot alter the chemical or mechanical action within the tissues of the properly administered electric current.*

But why put the patient in a tub of water? The method,

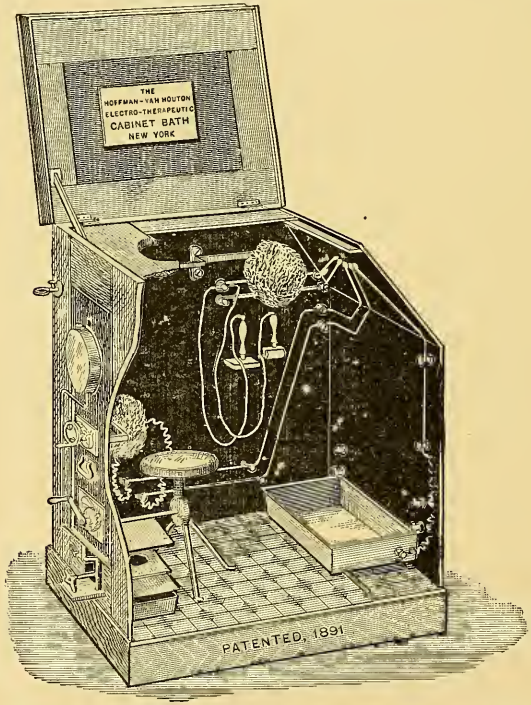


Fig. 324. Bath Cabinet (Van Houten and Ten Broeck.)

Either faradic or galvanic currents can be used, as the nature of the disease may indicate.

It is so constructed that the operator can give:

1. A Turkish bath—purely hot dry air.
2. A Russian bath—purely hot vapor.
3. A Turko-Russian bath—hot air and vapor.
4. An electro-vapor bath—currents of electricity with vapor or hot dry air.
5. An electro-medicated bath—incorporating pure medicinal drugs, so that the catathoric action of electricity will stimulate absorption.
6. A perfumed bath—combined with any of the above, thus removing all odors that may exhale from the skin and leaving an agreeable perfume in their stead.

however beneficial it may be when rightly carried out in detail, is one I never advise, but this is not because it is inherently pernicious but because I can do better. I can refresh the patient with all the grateful effects of either a Turkish or Russian bath without exposure of the person, without the pressure of a surrounding body of water, without the relaxing and enervating effects of a simple hot bath, and without diverting through the conducting water any part of the therapeutic dose of faradic or galvanic administrations. The apparatus by means of which this is accomplished is an electro-therapeutic cabinet—a box—in which the patient may sit and receive practically any form of local or general electrization with either galvanic or faradic current under the complete control of the operating physician while also enjoying a Turkish, Russian or medicated vapor bath. The patient's head is outside of the cabinet and is kept constantly cool. This is a kind of electric bath that can only be admired by every one who tries it personally.

I believe that the dry or moist heat, the profuse perspiration induced, the equalizing effect upon the circulation, the stimulation of the eliminating functions of the skin, the sedative influence upon irritated nerves, etc., render the conjunction of such a bath combining heat and water with electro-therapeutics a method of treatment adapted to a wide variety of cases.

Owing to the time, trouble and costly outfit it will hardly be available in the practice of the general physician, but wherever it can be conveniently employed it is wonderfully satisfactory. I am in the habit of administering with a vapor bath medicated with pine needle extract a mild galvanic current of 15 to 20 mil., united with a high-tension, rapidly-interrupted faradic current in cases where a sedative-tonic influence is desired without special local effect. For this purpose the positive electrode is applied to the cervical spine and the negative pole is attached to a foot tub of hot bicarbonate of soda solution in which the patient's feet are placed. It is exceedingly efficacious in diseases of the skin which arise from faults of nutrition, in dietetic disturbances and in nervous irritability. As a complexion beautifier I do not know its equal.

If such an apparatus for administering electricity and a bath together is properly employed it is an important therapeutic resource in many diseased conditions and its enjoyment is a luxury to those who are well. The chief difficulty in employing it relates to the trouble of getting the cabinet ready for a patient and putting it in order afterwards, for the duration of the treatment is but ten or fifteen minutes.

To obtain results which combine material benefit with the personal comfort and satisfaction of the bather calls for a

certain skill in technique which can only be acquired by experience.

The physician who wished to form an intelligent judgment as to the merits of what are vaguely called electric baths should therefore ignore the equally vague generalities of general text books and find out just what kind of an electrical treatment is meant. If it is good, skilful and proper treatment it is good, bath or no bath ; and if it is "quackery," the quackery is independent of the bath, for the benefit and merits of the application depend upon the skill of the physician and the implements he uses, and not upon the fact that the charlatans sometimes misuse good things that the profession neglects.

I do not regard a tub of water as a good situation in which to treat a patient with the usual forms of medical electricity, but I regard a cabinet bath apparatus such as I use myself one of the best possible situations in which to place a patient to obtain the best results in many cases when surface application, either local or general, is employed.

If I did not possess in the static machine the efficient means of making both general and local applications without disrobing the patient the cabinet bath as an adjunct to the uses of galvanic and faradic currents would be more nearly indispensable.

Its use in my own practice is a matter of choice in occasional cases rather than a necessity, and it illustrates again the advantage of having a complete equipment to enable us to select exactly the best form of treatment for each individual case.

The applications of electrodes within the cabinet are controlled by switches upon the outside of the case and the principles of treatment remain unaltered. It is therefore unnecessary, for two reasons, to devote a separate chapter to the description of methods for employing the electro-therapeutic cabinet bath. In the first place the applications described throughout this book are appropriate for use within the cabinet so far as the mechanism of the switches will permit them to be employed. In the second place the manufacturers give to each purchaser printed directions for the operation of the apparatus.

My own experience has led me to make certain alterations in the cabinet so that the patient is perfectly at ease during

treatment. In some cabinets the patient feels as if suspended by the chin and is glad to get out after a very few minutes. I have also made an improvement in the foot tub which makes it more convenient for the operator.

Central Galvanization and General Faradization.—Apart from *localized* applications the physician has no complex variety of methods to consider in the *general* employment of galvanic and induction coil currents.

The uses of galvanic currents for *general electrification* are practically limited to a single technique, and the general uses of induction coil currents for constitutional effects are similarly resolved to the one method called *general faradization.* The two procedures, C. G. and G. F., are inseparably associated together in electro-therapeutic literature, for either singly, together or in alternation they are practically the sole methods of general electrification within the range of galvanic and faradic currents. To remember this simplifies a considerable part of the subject.

General faradization is selected by those who employ it when reflex, peripheral or general tonic, nutritional and muscular effects are sought.

Central galvanization is selected when it is desired to influence the great nerve centres by the properties of the constant current. "It is better adapted to what may be called profound, vital depression than to functional lack of tone." Both methods are often required to supplement each other because of the physiological differences and limitations of the two currents.

Both methods necessitate the disrobing of the patient and contact of moist electrodes with the person. Some judgment and practice are the basis of proficiency, but the real inconveniences attending the clinical use of these methods are greater than the degree of special skill required.

The galvanic current possesses certain peculiar properties of its own, and sometimes the results it will produce cannot be attained so well by any other remedy. This is true of central

galvanization in cases when the action of the galvanic current is called for by special indications which cannot be met by either faradic or static currents. These cases are comparatively few.

Induction coil currents produce the general constitutional effects which are also produced by static currents, and hence the effects of general faradization may be obtained in other ways. There is however some difference between the sensory effects of skilful general faradization and the sensation produced by any other method of general electrification.

An impartial consideration of these methods in actual practice may be appreciated by physicians who have encountered a hundred references to them in medical writings without ever attempting their personal use.

They are electro-therapeutic procedures of great nutritional value. The theoretical indications for their employment in disease cover a wide range of cases. To the physician who has only galvanic and faradic apparatus they are "Hobson's choice," for he must either employ them or relinquish the use of medical electricity in the general practice which is its largest field.

Under the combined drawbacks of disrobing the patient and making an application which is tedious to those who use it seldom (just as horseback riding is laborious and difficult to those who ride but little) few physicians use galvanic and faradic currents for *general* applications.

In practical medicine we must deal with the patient as well as treat the disease, and the physician must also consult other demands upon his time. The merits therefore of the therapeutic action of any method cannot be discussed without taking into account its practical utility.

When the office equipment includes (*as it should*) a practical static machine the relative importance of "central galvanization" is reduced to a small number of cases and "general faradization" ceases to be necessary at all. The static machine provides methods of *general electrification without any*

disrobing of the patient, with only a reasonable tax upon the time, and in ways which render it useful throughout the whole range of office practice when general electrification is indicated.

From infancy to old age there is no person who can sit upon a chair so disabled that he cannot be subjected to the nutritional influences of static currents. Paralysis, pain, complicated clothing associated with physical disabilities, sentiments of modesty and lack of time may put fifty per cent. of office patients out of the easy reach of "general faradization," but none of these are drawbacks to the practical use of the more efficient apparatus, the Holtz machine.

In my clinic, even when I have desired to demonstrate the general galvanic and faradic methods to physicians, the inconvenience of the technique has been at once manifest to those who have seen case after case treated without inconvenience and without delay upon the static platform. In private office practice "central galvanization" is much the most feasible and will be found occasionally useful, but "general faradization" is impracticable in so large a majority of cases that better methods are instinctively preferred by those who command them. *It would indeed be a misfortune if electro-therapeutics contained no substitute for a method which requires the undressing and re-dressing of the patient, the greater or less exposure of the person, the direct application of a moist electrode or the hand to the entire surface of the body and the amount of time and inconvenience that general faradization involves.*

Equally valuable nutritional, constitutional, sedative-tonic or stimulating effects by general static methods may be obtained with far greater facility without removing even a hat or bonnet, cloak or overcoat, shoes, rubbers or gloves, if the patient has them on. In not a few respects we may procure therapeutic actions by general static methods which are hopelessly beyond the utmost capabilities of general faradic applications.

In many instances our ability to treat the patient without

personal exposure or touching the body with the hand at any point will be recognized in clinical experience as the deciding factor in extending to patients the benefits of medical electricity. Every moment the individual is seated upon the static platform with the machine in action he or she is receiving a *general electrification* which is more completely diffused throughout the body than it is possible to diffuse the currents of coils and cells; and appreciation of this fact will go far to enlighten the profession upon the comparative values of different general methods which aim at pretty nearly the same thing.

The indications for general faradization are summed up as follows:

1. To stimulate the whole system, add to its sum of vitality and enable it to throw off disease or resist fresh onsets.
2. To promote general nutrition.
3. To quiet general nervous agitation.
4. To procure natural sleep without drugs.
5. To provide passive exercise of muscles.
6. To reduce the fever, restlessness and pain of acute inflammatory diseases.*

"In the majority of cases persistence is required to obtain full effects from this method."

Central galvanization and general faradization are, one or both, especially mentioned as the available means of treating the following diseases with galvanic and faradic currents, either alone or in conjunction with other remedies:

Neurasthenia, spinal irritation, insomnia, hysteria, hypochondriasis, insanity, neuralgias, paralysis, locomotor ataxia, muscular atrophy, rheumatism, gout, arthritis nodosa, chorea, paralysis agitans, asthma, epilepsy, diseases of the skin, especially those of nervous or nutritional origin; nervous dyspepsia, constipation, chronic diarrhœa, jaundice, flatulence, seminal emissions, spasm of the glottis, nervous cough, functional disturbances of the heart, phthisis, exophthalmic goitre, the sequelæ of certain acute diseases, diabetes, Bright's disease, etc.

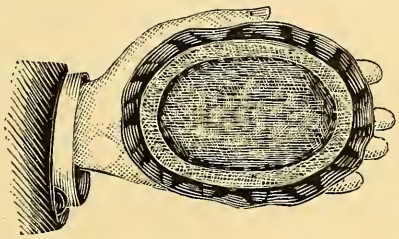
* By referring to the chapter upon the physiological action of static currents it will be seen how adequately they provide these desired effects.

For many of the above conditions the static machine affords a more practical means of general electrization, and can be employed with satisfaction in short sittings requiring no disrobing.

The clinical results compare more than favorably.

Central galvanization is administered as follows:

Remove clothing from trunk of body. Select a flat felt or sponge covered electrode, about 3×4, moisten it in the usual hot-water solution of bicarbonate of soda (about a teaspoonful to the pint). Connect it with the negative pole of the galvanic



POSITIVE.

Fig. 325. Sponge-covered flat electrode.

apparatus, and have the patient hold it with moderate pressure upon the epigastrium.

Fold a thick, soft sponge, moistened with the warm bicarbonate solution around a carbon hand electrode, and attach this to the positive pole. Manipulate it with the left hand,

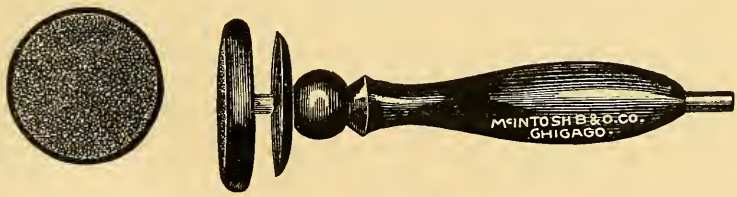


Fig. 326. Carbon disk electrode.

leaving the right hand free to regulate the current through the rheostat.

First, apply the positive electrode to the forehead and increase the constant galvanic current from zero to three mil.

Pass the electrode slowly across the entire frontal region for about one minute. Next remove the electrode to the vertex, and moisten the hair over the cranial centre, as dry hair is a poor conductor of electricity. Again increase the constant current from zero to about ten mil. or just enough to cause a little gentle pricking on the scalp and the familiar metallic taste. Hold the electrode still on the vertex for about two minutes, and then reduce to zero and shift the electrode to the back of the neck.

Increase the dosage again from zero up to comfortable tolerance, and this will be between ten and fifteen mil. if the skin is in a normal condition. If there are any abrasions or eruptions on the skin they will interfere with comfort even if the dose is kept down to as little as five mil. As soon as the comfortable current strength is regulated, slowly promenade the positive electrode up and down each side of the neck and around the base of the brain, influencing especially the pneumogastrics along the entire inner border of the sterno-cleido-mastoid on both sides for a couple of minutes.

Then move the electrode to the cervical spine without lifting it from the skin, and pass it up and down the entire length of the cord, increasing the current until it is perceptibly felt through the increased resistance of this portion of the body. The dose will now average between fifteen and thirty mil.

Eight or ten minutes should be spent on the spine about equally divided between the cervical and lumbar regions, without lifting the electrode while the current is passing. Reduce the current to zero through the rheostat before removing the electrode, then dry the spine briskly with a rough towel, and in private practice it adds to the comfort of the patient to dust the skin with toilet powder.

The negative electrode remains in one place all the time and must not be lifted from close contact until the sitting is ended. As it is easily held by the patient the operator has but one electrode to manage.

Avoid all sudden changes of current strength, and do not lift the positive electrode from contact at any time until the current is first reduced to zero.

Any convenient and light shawl or wrap may be thrown around the patient, both to limit the exposure of the person and protect from draughts.

If any abrasion, pimple or irritable redness of the skin is found on any part of the surface to be treated it must be protected, or avoided, to prevent a burning sensation as the electrode passes over it. In eruptive states of the skin or even when the skin is simply reddened the constant galvanic current feels unpleasantly irritating even when a small dosage is employed.

As the skin of sick people is often in a deranged condition this fact alone constitutes a very considerable drawback to the employment of this method, while static administrations may be made with equal benefit and without difficulty in the same cases.

Central galvanization is chiefly an intercurrent and auxiliary aid to other measures, and seldom constitutes a complete method of treatment in itself.

General faradization is administered as follows:

The treatment of the entire body may be divided into two parts, dealing first with the trunk and afterwards with the lower extremities.

First remove clothing from upper portion of body, also the shoes and stockings. Sit patient upon an ordinary stool with the feet resting upon the usual metallic reservoir electrode which is first filled with warm water and tightly corked. This is connected with the negative pole of any improved induction coil apparatus.

With the positive pole connect the metal ball electrode which is made expressly for this purpose.

Switch the rapid vibrator, 800 yard No. 32 coil and three or four cells into circuit.

Stand at the right of the patient; dip the left hand in warm

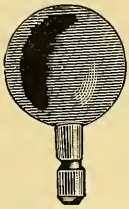


Fig. 327. Metallic ball electrode for general faradization.

water to slightly moisten it; grasp the nape of the neck with the palm of the left hand; hold in the right hand a large, soft and well moistened sponge and start the current into action.

There is yet no secondary circuit and no current reaching the patient. Complete the circuit by gradually pressing the sponge held firmly in the right hand down upon the positive ball electrode until the current passing through the operator is perceptibly felt by the patient where the left hand grasps the nape of the neck. The amount of current strength which can be tolerated agreeably by both the operator and the patient is regulated by the amount of contact between the sponge in the right hand and the ball electrode. The more pressure the more current. The less pressure and contact the less current. The knack of regulating dosage in this manner is easily acquired, but is the product of practice and not of reading.

With gentle massage manipulation to first one and then the other side of the neck promenade the left hand over the tissues, under each ear, and around the base of the brain. With a greatly reduced and very mild current next press the freshly moistened left hand upon the forehead with gentle movements for half a minute. Seize the root of the nose with the first and second fingers and pass the current steadily for half a minute. A good deal of care will be needed to adjust the current strength to the frontal region.

Next hold the left hand steadily upon the nape of the neck and gradually manipulate it around the shoulders, across the chest from axilla to axilla and massage groups of muscles, avoiding the nipples and bony prominences as these are sensitive to all currents.

Next grasp and manipulate each arm throughout its entire length. The abdominal muscles, the entire spine and region of liver, kidneys and spleen are next subjected to labile appliactions of the positive electrode with the current strength regulated to comfortable tolerance through the rheostat, instead of by sponge contact as before described. Owing to the stronger currents tolerated by these parts the hand of the operator cannot be comfortably employed as an electrode.

Transfer the sponge to the left hand and fold it around the metallic ball which is connected with the positive pole, leaving the right hand free to regulate the switch-board or participate in the manipulation of the muscles if desired.

Sometimes the moistened palm of one hand is clapped upon the abdomen at the same moment the sponge-covered electrode is applied to the spine, and in this way a strong current is divided and the application made particularly agreeable.

The body above the waist is then dried and underclothing resumed.

The patient then removes the clothing from the lower limbs and stands now erect upon the foot-plate while stroking passes of the sponge-covered, positive electrode are continued up and down each limb for several minutes. The current strength for the limbs is regulated to the point of causing mild contractions as different groups of muscles are passed over by the electrode.

The limbs are next rubbed dry with a towel and the sitting closed.

"General faradization" may be repeated daily when indicated, or three times a week. Some operators recline the patient upon a couch and cover the person with a sheet under which the application is made, and this is said to be the usual rule with female patients. The objections to this method of treatment for females are so obvious that they call for no comment, and among general practitioners there appear to be very few who find the method feasible.

The duration of sittings is subject to the discretion or convenience of the operator, who may omit the application to the lower limbs if he desires and confine the work for the most part to the spine. An ordinarily thorough treatment may be allowed to consume a little more than half an hour in expert hands, although in many cases an hour elapses between the coming and the going of the patient. Average sittings are said to be divided about as follows:

Undressing	5 minutes.
Applications to head	2 "
" to neck, chest and arms . .	6 "
" to spine back and abdomen .	6 "
" to lower limbs, two minutes each	4 "
Dressing and toilet	10 "
Total	33 minutes.

"In conditions in which general faradization is indicated and really beneficial the best results require a reasonable persistence, and a fair estimate of the total number of applications in average cases which present a favorable prognosis may be cited as ranging from 15 to 30."

In speaking of the indications for general faradization I do not mean to state that this method is indicated *per se*. *General electrification* for nutritional and tonic effects is indicated as often as iron, cod liver oil, the hypophosphites and similar remedies are indicated, but not necessarily through the medium of a form of current which involves the most troublesome technique. The indication is rather for the use of the current which accomplishes the end sought in the least time, without any disrobing and without extra trouble to either the patient or the physician. Currents which accomplish the valuable therapeutic results of general electrification with the greatest practical facility are derived from the static machine.

CHAPTER XXXVIII.

TREATMENT OF DIGESTIVE DISORDERS.

Dyspepsia and functional derangements of the alimentary canal. Nervous dyspepsia, galvanic and faradic methods. Intestinal dyspepsia. Gastralgia. Chronic gastritis. Cholera morbus. Cholera infantum. Colic. Nausea. Intra-gastric electrization. Treatment of constipation. Chronic cases. Galvanic and faradic methods. Static sparks. Simple atonic constipation. Intestinal obstruction. Hydro-electric douche method. Intestinal obstruction following abdominal surgery. Intestinal inertia with flatulent distension. Alternate constipation and diarrhœa. Torpid liver. Enlarged liver or spleen.

Dyspepsia and Functional Derangements of the Alimentary Canal.—Constipation, diarrhœa, colic, nausea and pain are all relieved by local static applications as I have shown elsewhere, but curative effects relate chiefly to cases in which these symptomatic disturbances are reflex or functional.

Dyspepsia may be limited to mean nothing more than a troubled action of the stomach, which can be restored to normal by toning up the nervous system, the secretory glands and muscular fibres of the digestive apparatus. This whole improvement, involving a stimulation of circulation and the re-invigoration of nutritive forces, is well within the physiological action of static electricity.

The direct application of a static spray or spark upon a catarrhal inflammation of the surface of the body will often heal up the process, but such general administrations as can be applied to catarrhal states of the alimentary canal are not effective in curing such a form of dyspepsia. As a rule almost all cases of gastric derangement are treated by other therapeutic measures, but static electricity will do no harm in any case, will help the majority of cases, and therefore aid the action

of other remedies, and in nervous cases it is one of the best possible methods of treatment.

If there are soreness and stiffness in the abdominal muscles, or any reflex or neuralgic pains, these symptoms are quickly removed, with very great satisfaction to the patient. If the digestive trouble is due to a lesion, either more difficult to cure or entirely outside the range of static action, we may greatly reduce the reflex irritability and increase the tolerance of the patient so much that the exciting cause creates far less disturbance than formerly.

Lajoie * published a report of sixty observations of dyspepsia which he had treated by electricity, from which the following is taken:

CASE I. A young man, aged 27, Mr. L——, came to me in 1892, having been troubled for the last two years with more or less heaviness in the head. There was no pyrosis, no gases were belched up. There was no vomiting or nausea. The bowels were regular, though at times somewhat costive. But what the patient came to me was for this, a symptom which I was unable to find mentioned in the books I have read on dyspepsia, viz.: almost every night he felt a soreness over the abdomen. Pressure would neither increase nor diminish the soreness, but change of position would. This would be felt from two or three o'clock in the morning until half an hour after rising. The soreness caused uneasiness and sleeplessness. Meals were taken regularly and did not distress him nor cause any trouble; apparently digestion was good.

After a thorough examination, and I must add some hesitation, my diagnosis was: Intestinal nervous dyspepsia.

After a fourteen weeks' treatment with static electricity he was perfectly well and has remained so up to three days ago, when I last saw him. The positive pole was connected with the stool and the negative used to draw the spark, commencing with the pointed electrode, then gradually coming to the one with the large ball—the sparks increasing in intensity as I went along.

CASE II. That of Mr. S——, 30 years old. After examination and history of the case, I concluded to give him Ewald tests, with salol, iodo-potassium at his next morning's meal, and examine him an hour after. The man was rather thin.

* *Journal of Electro-Therapeutics*, October, 1895.

After examining the stomach I was surprised to feel the cardia hard under my hand, then gradually that hardness went on as a wave toward the pylorus; one could *see* the peristaltic action of the stomach.

The tests showed retardation of digestion. After ten weeks of electrical treatment the man was well and digestion normal.

CASE III. Mr. H—— sent for me, August 10th, 1895, for heart disease. For the last three weeks he had been unable to sleep more than a few minutes at a time, his heart *thumped so hard.*

No organic trouble was found upon examination of the heart. Gas was belched up frequently. This patient was living on milk, oatmeal and the like. I gave him as a diet the whites of two eggs beaten in spring water, five or six times a day. Positive static electricity as treatment was given every day for the first week, then every other day.

In twelve weeks that man could eat and digest steaks, chops, etc., and his heart caused him no more trouble.

CASE IV. Mr. E——, aged 26. Food takes a long time to properly digest; gas belches up; nausea recurs frequently; no vomiting; bowels irregular; headaches often; pain in the back along the spine, and obliged to urinate very often, but it is painless. Rides the bicyle often.

Faradic current with coarse coil was given, positive pole over the stomach, negative in the lumbar region. I made this patient stop riding his bicycle, and with the electrical treatment he was made well in eight weeks.

I will limit my reading of observations to these, but will now present a few conclusions:

1. In every case of dyspepsia, static electricity will cure or help to cure. Even a case of cancer of the stomach has been greatly benefited by this treatment.

2. Neurasthenia or hysteria manifesting themselves by dyspeptic symptoms are always cured or benefited by electricity.

3. Electricity has the effect of stimulating the general nutrition.

4. It has the effect of correcting any insufficient or perverted innervation of the stomach.

5. Of regulating, first, the action of the glands of the stomach, and second, the hydrochloric acid in the stomach, lessening it when the quantity is too great, and increasing the amount when too little.

6. Give treatments from five to fifteen minutes' duration, beginning with small doses, gradually increasing them as the benefit is greater, until the maximum beneficial dose is reached. The state of the patient being your *meter.*

7. When nutrition is disturbed, electricity has the special effect of bringing it back to the normal, and that result never fails when there is no irreparable anatomical lesion.

8. Electro-therapy, in every disease where the nervous system is a factor, will help greatly, if it does not itself alone effect a cure.

Nervous Dyspepsia.—*Galvanic and Faradic Methods.*—At the beginning of treatment regulate the diet and hygiene of the patient as far as possible. With assistance in these directions electricity will often produce better results than any form of medication without electricity.

Have the patient press a negative felt or sponge covered electrode the size of the palm over the solar plexus. Wrap a

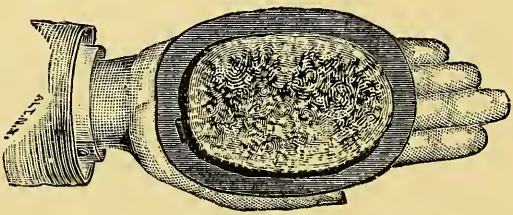


Fig. 328. Sponge-covered flat electrode.

large soft sponge about the large carbon hand electrode and connect it with the positive galvanic terminal. Moisten both electrodes in the same hot-water solution of soda bicarbonate.

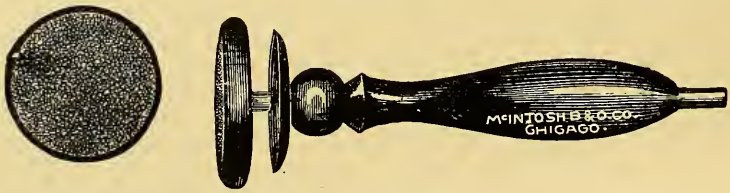


Fig. 329. Carbon disk electrode.

Apply the positive to the back of the neck and increase the constant galvanic current from zero up to 10 mil. In three minutes pass the positive electrode to the side of the neck

just below the ear. Two or three minutes later pass it to the opposite side and the same situation, keeping the current at the same dosage. Next reduce to zero and transfer the conducting cord to the high-tension induction coil apparatus. Switch into circuit the 800 yard No. 32 coil, the rapid vibrator and four cells. With the anterior electrode still held over the solar plexus promenade the spinal electrode up and down the entire back for five minutes with the current regulated to produce an agreeable thrill. Total sitting about fifteen minutes. Dust the skin with toilet powder after withdrawing the electrodes. Repeat daily until some improvement is established, then three times a week until satisfactory results are obtained.

Intestinal Dyspepsia.—Atonic forms with constipation have been successfully treated by combining atonic and nutritional electric currents with the usual dietetic and drug prescribing. While considerable has been written about the treatment of gastric, hepatic and intestinal derangements with electricity, yet in ordinary practice physicians and patients will usually prefer orthodox prescribing and electricity will be a last resort. It suffices to say that under such circumstances the results are often disappointing, and as a matter of fact the employment of electric currents around the trunk of the body by methods which require disrobing is objectionable to the majority of patients.

Central galvanization, general faradization and the local use of the faradic current with one electrode either in the rectum or upon the lumbar region and the other promenaded over the course of the colon are methods employed in these cases.

When the patient is seated upon the static platform no disrobing is required and long sparks over the entire spine, the region of the liver and the course of the colon, followed by brisk frictional counter-irritation and supplemented by medical prescribing, will do for these cases about all that can be accomplished by the assistance of electricity.

Gastralgia.—Seat the patient upon a chair with the clothing

Figs. 330. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

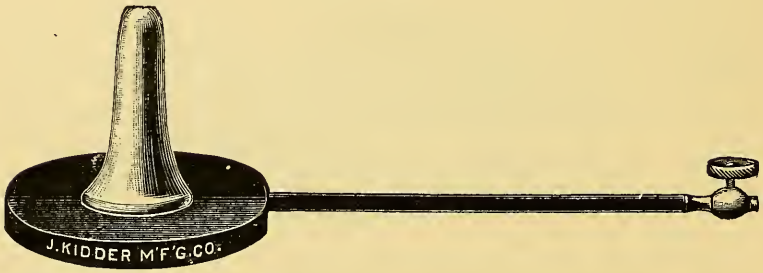


Fig. 331. Rectal electrode for use in a sitting position.

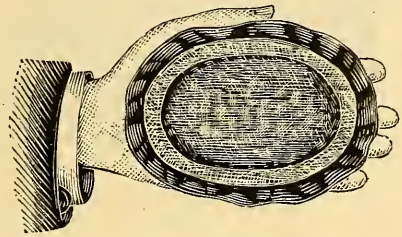
loosened about the neck and abdomen. Connect two small electrodes about an inch in diameter with the positive pole of

Fig. 332. Ordinary sponge-covered hand electrode.

the galvanic battery by a bifurcated cord, moisten the covering with the usual hot-water solution of soda bicarbonate and press them upon the right and left pneumogastric on each side of

the neck above the clavicle and between the insertion of the sterno-cleido-mastoid.

Moisten a felt or sponge covered, flat electrode, about 4 × 6, in the same bicarbonate of soda solution, connect it with the



POSITIVE.

Fig. 333. Sponge-covered flat electrode.

negative pole and have the patient press it over the epigastrium,

Gradually increase the constant galvanic current through the rheostat from zero up to a dosage which will afford relief, and when this is apparent maintain the current steadily for a sufficient time—often fifteen or twenty minutes. The average dose will vary between five and fifteen mil.

The above application is directed to the relief of the attack of pain. Other measures must be employed and the diet regulated to bring about a permanent cure. The galvanic current is however a useful aid to medical prescribing,

The positive static spray and counter-irritation by frictional sparks over the spine and abdomen may also be found useful.

Chronic Gastritis.—Electric currents play a very small practical part in the treatment of affections of this character. They may relieve symptoms and contribute to the results which medication and diet may procure, but in old and discouraged cases any help that may be obtained from electrotherapeutics is welcome.

Place the patient recumbent on the back. Moisten a felt-covered, flat electrode, about 5 × 8, in the hot-water solution of bicarbonate of soda, connect it with the positive pole of the

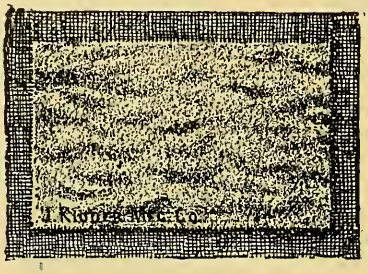


Fig. 334, Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs,

galvanic battery, and apply it over the stomach. Prepare a similar electrode, connected with the negative pole, and place it under the cervical spine. Gradually increase the constant galvanic current from zero until it produces a sensation of comfortable warmth through the tissues. In about fifteen minutes reduce to zero.

A similar application may be made with the rapidly interrupted high-tension induction coil current with the same electrode under the dorsal spine, and a smaller sponge-covered electrode, about three inches in diameter, over the pylorus.

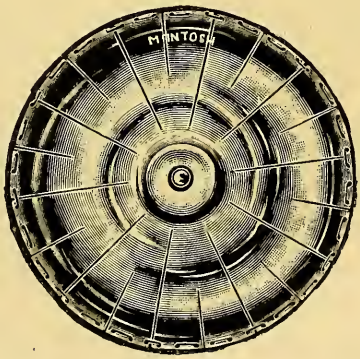


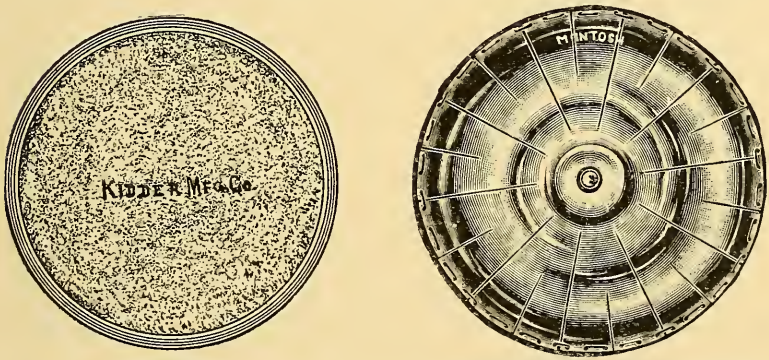
Fig. 335. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

Adjust an 800 yard No. 32 secondary coil current up to comfortable tolerance. Continue for about fifteen minutes and reduce to zero. Repeat three or four times a week.

Static frictional sparks over the abdomen and spine, together with general electrification, will be found useful to aid appropriate medical and dietetic measures.

Cholera Morbus.—A patient suffering from this acute affection may often be given remarkable relief in one of two ways. I have personally employed static sparks on the abdomen with almost instant relief to the colic in the few cases which have occurred in my office practice. These patients are more usually seen at home, and when it is considered worth while to do so an induction coil apparatus can be employed.

Moisten a felt or sponge covered, flat electrode, connect it



Figs. 336. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

with the positive pole, and place it under the dorsal region. Place a similar negative electrode over the abdomen, and increase the rapidly interrupted secondary coil current from zero until it produces a sedative-tonic effect. Continue the application for about twenty minutes. Electricity will rarely be used in this affection.

Cholera Infantum.—I have seen tonicity and normal action of the bowels restored in several cases of infantile diarrhœa by the simple action of positive static electrification with the

child held by the mother on the platform. When treated at home the infant may be very greatly helped by passing a mild high-tension rapidly interrupted induction coil current directly through the body from the back to the abdomen, and also by means of the tonic bath described in another place.

Colic.—I have repeatedly given relief to lead colic, flatulent colic, etc., by static sparks over the gastric region in cases who were thus affected at the time of coming for other treatment. It would scarcely occur to a patient to seek relief from colic by a visit to the electro-therapeutist, but it is sometimes useful to know that such symptoms can be relieved without extra trouble during a regular course of treatment for some more formidable affection.

Nausea.—I have relieved a number of cases of simple nausea occurring in patients undergoing treatment for other conditions by a few moments' application of the static breeze to the region of the stomach. In other cases dependent on uterine reflexes bipolar faradic sedation has removed the nausea, and even in the "morning sickness" of pregnancy it has given as much relief to the patient as any other remedy tried.

Intra-gastric Electrization. — Intra-gastric electrization, both by an electrode which is swallowed and in the form of an electric douche, has been recommended with some enthusiasm, and a considerable number of experiments on frogs, rabbits and a few dogs have been reported in medical journals to demonstrate its value. In my own experience the superior facilities and more effective resources of static electricity obviate the necessity of employing faradic or galvanic methods which are so objectionable to patients. If we admit the full sum of value claimed for intra-gastric electrization by its advocates we have only to say that we have other means which are more satisfactory and quite as efficient.

Treatment of Constipation.—For the purchase of mineral waters, salts, syrups, pills, tablets and other laxative preparations the people of the United States spend perhaps ten million dollars yearly. In theory electrical currents are successful

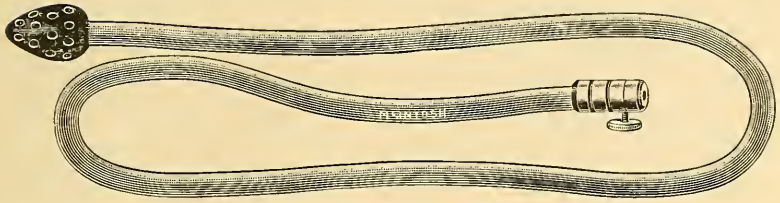


Fig. 337. Stomach electrode.

For the application of galvanic or faradic currents within the stomach. This is a very flexible electrode insulated with very smooth colon tube, the olive point being of hard rubber with perforations, so that the current only comes in contact with the mucous surface through an aqueous medium previously injected.

remedies for some of the conditions on which constipation depends, but in practice electricity is about the last remedy that will either be suggested or employed by the physician. The reason of this will be apparent to any one who compares the facility of swallowing a pill with the conditions of electrical treatment. It is however important to state accurately the functions of electric currents and to state how to use them for the benefit of patients who have reached the point when the trouble of electro-therapeutic technique is the lesser of two evils.

The principles involve (1) increasing the action of the liver by reducing venous engorgement and increasing the arterial blood supply, thus increasing the nutrition and normal secretions. (2) Stimulating the nervous and muscular tissues and glands of the intestinal tract. The following methods accomplish these objects.

Moisten a felt-covered, flat electrode, about 5 × 8, in a one per cent. hot-water solution of bicarbonate of soda, connect it with the positive pole of the galvanic battery and place it over the anterior region of the liver. Prepare a similar electrode, connect it with the negative pole and apply it to the posterior region of the liver. Gradually increase the constant galvanic current from zero up to 20 mil., and in cases where no sensitiveness prevents carry the dosage up to between 30 and 40 mil. In about ten minutes reduce the current to zero and switch the automatic interrupter into circuit, again increase the cur-

rent strength sufficient to produce vigorous but comfortable contractions at a slow rate of about fifty per minute. In three minutes again reduce to zero, remove the electrodes and shift the positive electrode to the sacral region.

Select a flat, sponge-covered hand electrode, about 3 × 4, moisten it in the hot-water soda solution and lubricate it with a little soap. Connect it with the negative pole. Apply this negative electrode labile over the abdomen for about five minutes with a current strength of about 20 mil. Hold it steadily for a minute over the sigmoid flexure and close the sitting.

If the rectal membrane is very dry (as thousands have been dried by the habitual use of enemas and the injurious glycerine suppository) it is necessary to correct the condition by applying the negative galvanic current directly to the mucous membrane. This may be done by either a hydro-electric douche or by the insertion of an ordinary bare metal rectal electrode as will be next described.

In treating a case of constipation with electricity the greatest trial will be between the beginning of the treatment and the first movement of the bowels. All these cases have been accustomed to the long continued use of cathartics, and of course, with the discontinuance of the cathartics, there is great reaction. It will also be found that these cases have a morbid idea that they must have daily movements and also very large movements, and it is sometimes necessary to use considerable argument to get them to discontinue their use. This however must be done, for electricity given in conjunction with cathartics is apt to fail in producing the permanent results for which treatment should always be given. After the first movement has been accomplished no fear may be entertained of the cure. While the patient may not have a stool daily (as in cases I have reported) they will have them frequently enough and will gradually improve until daily movements are accomplished.

I seldom change the diet in any way but always insist upon regularity of habit. Unless they are regular in their habits the cure will not be permanent. (*King.*)

In chronic cases addicted to the use of enemas with large

rectal cavity, weakened muscular fibres, very large, hard stools, and in fact nearly all cases of either deficient secretion or deficient peristaltic action which are hopelessly dependent on drugs, the patient may be beneficially treated by both galvanic and faradic currents, the former being best adapted to commencing treatment in cases which are particularly obstinate.

Galvanic.—The beneficent action of simple hot saline enemas has long been known. A fortune has been made out of a popular method of treatment of this character. By referring to the chapter upon the physiological action of galvanic currents upon secreting cells and non-striated muscular fibre it will be observed that a combination of the saline enema and the galvanic current is a remedy of decided therapeutic value. It is either curative itself, or efficiently prepares the way for faradic stimulation of other muscular fibres which will establish the improvement.

Moisten a felt-covered, flat electrode, about 6×9, in the usual hot-water solution of soda-bicarbonate, connect it with the positive pole of the galvanic battery and apply it with sufficient pressure to the patient's abdomen. Prepare between two and three quarts of a solution of rock salt reduced one-half below the point of saturation. Regulate the temperature to

Fig. 338. Rectal electrode for hydro-electric applications to the intestinal tract in occlusion, peritonitis, constipation, intestinal catarrh, enteritis, simple, pseudo-membranous, or follicular, etc.

comfort, connect the rectal electrode both to the rubber tube of the irrigator and the negative pole of the galvanic battery, lubricate it with a little vaseline, and insert it as far within the rectum as possible.

Allow a moment for the patient to quiet the muscles after

insertion and let the fluid flow through the electrode with the pressure of just sufficient height to establish a gentle and continuous current. This current of water becomes the electrode. Gradually increase the constant galvanic current from zero up to about 20 or 30 mil., and from time to time stop and renew the flow of water if the patient's control over the sphincter is uncertain.

The amount of solution to carry into the bowels may vary according to each case from a pint to the full contents of the irrigating jar. It should be retained as long as possible.

After about five minutes reduce the galvanic current to zero and reverse it. Again raise the dosage gradually to 20 mil. If peristaltic action is not set up by this means within another five minutes make the reversals more abrupt. Either with or without successful results, close the first sitting after about fifteen minutes. Repeat daily for a sufficient number of times to establish a complete emptying of the bowels with an improvement in peristaltic action.

Then substitute either faradic contractions of the abdominal muscles in the manner about to be described, or treatment with static electricity, and either discontinue the hydro-electric douche altogether if the case progresses or employ it about once a week for a few weeks to reinforce other measures.

Faradic.—With the patient in the dorsal position and the

Fig. 339. Rectal electrode, bare metal.

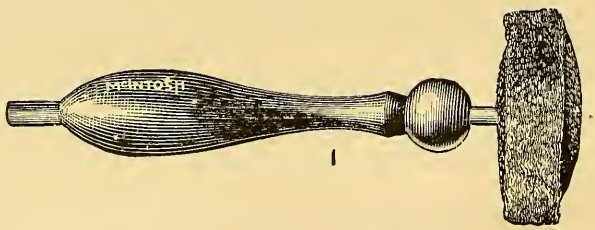


Fig. 340. Sponge-covered hand electrode.

abdomen fully exposed insert a rectal electrode connected with the negative pole of a high-tension induction coil apparatus. Moisten a sponge-covered hand electrode with hot water, lubricate it with a little soap and connect it with the positive pole. Place this electrode in firm contact with the skin pressed deeply down over the region of the gall bladder. Regulate the rapidly interrupted secondary induction coil current from zero up to the point of producing a strong but comfortable contraction of the tissues beneath the electrode. The switch arm selecting the different coils may be moved from one to the other until the correct coil is in circuit in the author's apparatus, without producing any shock to the patient and without stopping the current. Next promenade the hand electrode over the course of the large intestine to produce massage effects.

Static sparks are not curative of constipation *per se*, but in many cases of general negative states of the health other appropriate measures are advantageously supplemented by the nutritional effects of sparks upon the spine, lumbo-sacral plexus and abdomen.

As they can be administered in a couple of minutes without removing any clothing, they can often be employed when local applications of galvanic and faradic methods would be out of the question. In this way constipation may sometimes be relieved, but as a direct remedy for chronic constipation static sparks are utterly inadequate. Their usefulness is to be found in their facility of application during the course of treatment for states in which constipation is a minor symptom.

On the 10th of August, 1781, one of the most capable and well-informed medical electricians of that time wrote to a member of the Royal Society of London:

> In the course of my practice I have observed a very remarkable effect of electricity upon the human body, which is, that it removes costiveness in those persons that are electrified, especially along the course of the alimentary canal. I must

observe that it does by no means increase the evacuation of ordinary good habits of the body but only reinstates the usual discharge in case of costiveness. This effect seems to take place because the electrization gives vigor and energy to the fibres of the debilitated intestines in the same manner as it restores the motion of more external muscles.

Simple Atonic Constipation.—The following general faradic method may be employed.

Moisten a felt-covered, flat electrode, about 6 × 9, in hot water, connect it with the positive pole of the induction coil apparatus and have the patient sit on it upon an ordinary stool. If the physician possesses the usual and useful reservoir electrode this may be filled with warm water and employed in the same way with greater satisfaction to the patient, as it is perfectly dry, while the other wets the skin and without care will often wet some of the patient's garments.

Connect an ordinary sponge-covered hand electrode with the negative pole and regulate a rapidly interrupted secondary coil current up to comfortable tolerance of the abdominal and spinal muscles.

With this current in action promenade the negative electrode gradually over the whole trunk of the body except the breasts, the region of the heart and sensitive bony prominences. Promenade it up and down the back across the lumbar region, over the course of the large intestines and particularly over the region of the liver. Entire sitting about fifteen minutes. Repeat daily for a week or until there is a decided improvement in peristaltic action. Maintain the treatment every second day until the benefit seems established. Continue sittings twice a week for a little longer in chronic cases in which permanent effects cannot be expected without sufficient persistence to re-establish the normal functions.

Intestinal Obstruction.—Saturate a felt-covered, flat electrode, about 6 × 9, in the usual hot-water solution of bicarbonate of soda, connect it with one pole of the galvanic battery.

In any form of irrigating jar mix one quart of warm water

and enough common rock salt to make a saturated solution. Add another quart of water to dilute the solution one-half. Connect the rubber tube with the hydro-electric rectal electrode which is also connected with the remaining pole of the

Fig. 341. Rectal electrode for hydro-electric applications to the intestinal tract in occlusion, peritonitis, constipation, intestinal catarrh, enteritis, simple, pseudo-membranous, or follicular, etc.

galvanic battery. Correct the temperature of the water to suit the purpose of an enema. Lubricate the surface of the electrode and insert it slowly and carefully as far into the rectum as it will go. When it can be inserted no farther we must be satisfied even if the distance is only two or three inches, but if it is five or seven inches it is much better, as the liability of reflex action upon the sphincter ani is reduced.

After allowing any temporary irritation to subside open the stop-cock of the irrigating jar until the stream runs with moderate force into the intestines. Owing to the construction of the electrode it will run very slowly and is absolutely without danger. Now gradually increase the constant galvanic current from zero up to 20, 30 or 40 mil., if the latter amperage is comfortably tolerated. At the first sign of inability to retain the injection or accept any increase for the moment stop the flow until the sensation passes away. By a little manœuvring the amount injected may be carried beyond a pint up to a quart, two quarts or more.

Meanwhile the current should be regulated with a view to producing decided intestinal action. The constant galvanic current will produce contractions of non-striated muscular fibres, and will therefore set up peristaltic action without interruption.

At the commencement of the sitting make the electrode

over the solar plexus positive and the rectal electrode negative. After three or five minutes reduce the current about one-half and reverse the polarity and again slowly increase to the full dose. Sittings of this character are very uncertain as to duration, for they may be cut short by the uncontrollable desire of the patient. If however it is possible to continue the action of the current and retain the injection for from fifteen to twenty minutes it should be done. During this time accomplish several reversals of the current and close the sitting with the rectal electrode negative. When the current is reduced to zero withdraw the electrodes and await results.

The patient should retain the solution until the desire to evacuate becomes uncontrollable and when this point is reached he should then reverse his efforts and make every endeavor to secure a full and free evacuation.

Results.—1. The result of the first application may be only the passage of the salt solution, either alone or accompanied by a little gas or slight liquid matter; or,

2. An abundant evacuation may take place.

In the first event the application should be repeated in a few hours and may be repeated three times during the first twenty-four hours if the obstinacy of the case requires it. If the first, second or third electric injection produces a full and happy result the further treatment may be accomplished by ordinary medical or electrical prescribing.

If successive administrations produce only partial relief but yet do not develop any contra-indications for delay, repeat the process once daily until success is achieved, even if this requires a week or more.

After intestinal action in an obstinate case is established by the aid of the galvanic stimulus the return of normal peristalsis may be slow, and the aid of the current should not be wholly discontinued so long as it is needed, but the intervals between applications can be gradually lengthened.

The technique of this method is extremely simple. It can be employed by any one. The report of results produced in

several hundred cases is one of the most interesting narratives in electro-therapeutics. Some of these cases have been stercorate impaction, some intestinal paresis, some have been invagination of the gut, but in any desperate case of this character with profound auto-intoxication, symptoms of threatening collapse or even of peritonitis, with the abdomen flatulent, sensitive to the touch and few accurate guides to the diagnosis, it is exceedingly difficult to determine the cause before treating the patient.

In any case of intestinal occlusion which has passed beyond ordinary prescribing the first and most important procedure, which holds the front rank among conservative measures and should always precede a surgical consultation, is the galvanic current employed as above described. A few years ago when, in Paris, it was reserved as a *last resort*, Boudet cleared the intestines successfully in 70 per cent. of his cases and Larat in more than half his cases. Some of these were already too near collapse to rally from an anæsthetic if surgery had been attempted. In ordinary and simpler cases the method is almost certain to be successful. It is superior to either harsh purgatives, effervescing enemas or the faradic current, although the latter has been employed with satisfaction in a great many cases.

Doumer also contributes his testimony to the practical usefulness of electric currents before considering operative procedures.

In the treatment of this affection almost all forms of electricity may be employed, but time should not be lost in using methods of doubtful efficacy. We should have recourse at once to the best and most rapidly acting methods. These are percutaneous galvanization and rectal galvanization.

Percutaneous galvanization is a very simple method.

The two electrodes, well moistened, are placed upon the abdominal walls, and a current of from 15 to 20 ma. sent through them, being interrupted about four times a minute.

Unless there are contra-indications the electrodes are slowly

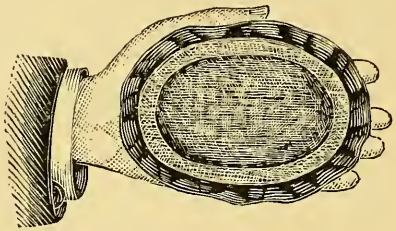


Fig. 342. Sponge-covered flat electrode.

moved about over the surface of the abdomen, especially in the neighborhood of the iliac fossæ.

If a good movement does not follow after two such applications of ten minutes each, given two or three hours apart, then intra-rectal galvanization must be used.

It should be applied according to the method of Dr. de Boudet of Paris. (*Described above.*)

Apart from its employment in chronic constipation, the hydro-electric douche or Boudet method may have occasional uses and special value in some portion of the treatment of a variety of diseased conditions of the gastro-intestinal tract. It is thus recommended in chronic diarrhœa due to fermentative and putrefactive conditions in intestinal catarrh, in simple or follicular enteritis and in chronic thickening of the mucous membrane.

Intestinal Obstruction Following Abdominal Surgery.—"In abdominal surgery one is constantly watching the behavior of the intestines. They are our prominent point of attack in our preparatory treatment, they are our greatest source of anxiety during the operation, and upon their management after the operation much watchfulness is imposed. All of this anxiety is caused by our desire (with the exception of care against wounding when operating) to prevent obstruction." (*Martin.*)

The causes of these obstructions are thus stated by Ashton:

Adhesions between the intestines and raw surfaces.

Paralysis of the intestines.

Local spasm of the intestines.

Impacted fæces.

Adhesions between coils of intestines or between the gut and neighboring parts due to traumatic inflammation.

Kinking or twisting of the intestines.

Slipping of a coil of intestines through an aperture.

Including the intestines within the loop of a suture of the abdominal wall, or between the edges of the abdominal incision.

In any case of failure to secure intestinal action by the ordinary measures which are employed after an operation it would be exceedingly difficult to tell which one of these various causes was present. A hydro-electric douche as described under Intestinal Obstruction would be a conservative measure to employ before proceeding to discover the cause by a second operation. The galvanic stimulus is very much more effective than full doses of strychnia or cathartics and would assure relief in some of the cases. Its simplicity and ease of management is a recommendation in its favor. The chief counter-indication is ulceration with liability of rupture.

Intestinal Inertia with Flatulent Distension.— In old cases of dyspepsia, in general debility and from improper diet and the habitual use of purgatives, the gases as well as the liquid contents of the bowels are often retained, and a condition of semi-paralysis is present. The bowels become distended with aggravated tympanites. Remedies have very little action. To excite the contractions of the intestines both the galvanic and induction coil currents are valuable.

Galvanic.—Place the patient recumbent in the dorsal position. Insert high up into the rectum a stout rubber tube which will remain patulous for the escape of incarcerated flatus. Moisten a felt-covered, flat electrode, about 5×8, connect it with the negative pole of the galvanic apparatus and place it under the lumbar region. Moisten in the soda solution a large soft sponge and wrap it around the carbon hand electrode connected with the positive pole.

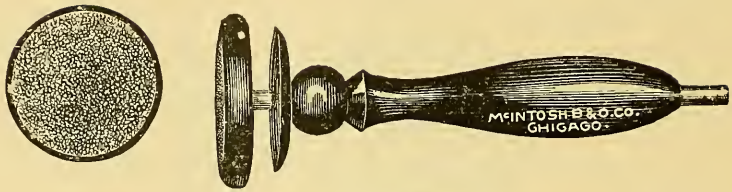


Fig. 343. Carbon disk electrode.

With a current strength of about 15 or 20 mil. slowly promenade the hand electrode along the course of the large intestine for about fifteen minutes. Reduce the constant current to zero, switch the interrupter into circuit and again increase the current strength sufficient to cause a few vigorous but comfortable contractions ; then reduce to zero and remove the electrodes.

If the patient is treated at home in bed the rubber tube may be left in the rectum to facilitate the escape of flatus. It can be removed when it becomes uncomfortable.

Another effective method to use at the beginning of treatment is the hydro-electric douche (Boudet Method) as described for intestinal obstruction.

Fig. 344. Rectal electrode for hydro-electric applications to the intestinal tract in occlusion, peritonitis, constipation, intestinal catarrh, enteritis, simple, pseudo-membranous, or follicular, etc.

The galvanic current is most efficient in the early stage of treatment. A little later the faradic may be applied in the same way, but all who possess a static machine will find it easier to continue the treatment with static frictions and sparks over the spine and abdomen after the galvanic current has established peristaltic action and stimulated intestinal secretion,

The regulation of diet and attention to the functions of the liver is important.

Alternate Constipation and Diarrhœa.—When any pathological condition of either the rectum or intestinal tract has been corrected, or if none is found to exist, and if the condition is considered due to irregular peristalsis, treat the patient at first with two or three applications of the hydro-electric douche with the constant galvanic current as described for constipation, and afterwards give a regular course of static treatment with mild positive sparks over the spine and abdomen. If no static apparatus is at hand treat the patient by the faradic method described under constipation.

"Torpid Liver" Jaundice.—Moisten a felt or sponge-covered electrode about the size of the palm of the hand, connect it with the negative pole of the galvanic apparatus and apply it to the posterior region of the liver.

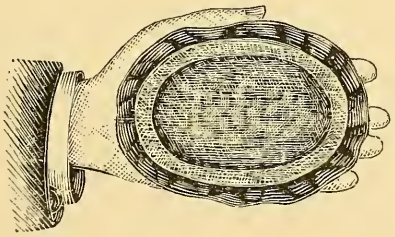


Fig. 345. Sponge-covered electrode

Connect with the negative galvanic pole an ordinary sponge-covered hand electrode. Promenade it slowly over the side and anterior region of the liver with a constant galvanic current of 15 to 20 mil., regulated to the comfort of the patient. In about ten minutes reduce the current to zero and close the sitting with a few strong interruptions. Repeat daily for a few times and afterwards three times a week until normal conditions are restored.

The above method (with both galvanic and faradic currents) with variations to suit the ideas of different writers has been employed for many years, but requires the patient to disrobe,

Results which appear to be practically as good are obtained, without removing any of the clothing, by the use of the static machine. In my own clinical experience the static method has become my own choice and the choice of chronic patients who have been treated at different times by the other current.

Static.—Seat the patient upon the static platform connected at first with the negative pole. Ground the positive pole and the brass ball electrode. Button the coat tightly around the body. With the machine in moderate action (after explaining and preparing the patient for what you are about to do) rapidly advance the electrode to contact with the spine and rapidly rub it a few times up and down, around the right side and across the abdomen.

Withdraw the electrode just as soon as sufficient counter-irritation is produced for the moment and repeat the manœuvre, at intervals of a moment for rest, about half a dozen times. The object is to produce a vigorous counter-irritation over the region of the liver. If either the weather or the patient's garments reduce the activity of the application change the platform rod to the positive pole and proceed as before.

Enlarged Liver or Spleen.—*Galvanic.*—The galvanic current may be made supplementary to the usual methods of treatment.

Moisten a felt-covered, flat electrode, 4 × 6, in the usual hot-water solution of bicarbonate of soda, connect it with the positive pole of the galvanic battery, and apply it over the organ anteriorly. Place a similar electrode on the upper spine and connect it with the negative pole.

Gradually increase the constant galvanic current from zero up to 20, 30 or 40 mil. according to the tolerance of the skin.

After ten minutes reduce the current to zero and switch the automatic interrupter into action. Adjust this to a rate of about 70 periods per minute, and increase the current strength until strong but comfortable contractions are caused. In about three minutes reduce the current to zero, remove the

electrodes, dust the skin with toilet powder and close the sitting.

Repeat daily for a few times and then three times a week until benefit ceases. This method requires the removal of clothing, and in many cases would be more trouble than the patient would accept. The benefit to be derived is uncertain.

Static.—Seat the patient upon the static platform and connect it with the negative pole. Ground the positive pole, and after familiarizing the patient during the first sitting with simple electrification, ground the brass point electrode and apply a positive spray over the entire spine, the right side and anterior regions of the liver and spleen.

These steps are simply preparatory to counter-irritant frictional sparks which are the effective part of the treatment, but which should never be employed with a new patient at the first sitting.

Having advanced by milder steps, next ground the brass ball electrode with the patient connected with the negative pole. Start the machine into very moderate action with a mild current, and quickly advance the electrode to actual contact with the dorsal spine. With very rapid passes move it up and down the back across the lumbar region around the right side and back and forth over the liver and spleen.

To secure sufficient effect the intensity must be very greatly increased over the initial application, and this is accomplished by gradually increasing the speed of the revolving plates, and if need be by changing the platform rod from the negative to the positive pole.

If the clothing is non-irritating this deficiency must be supplied by handing the patient a wrap of suitable material kept for this purpose. Also give a few long percussive sparks over the spine, liver and abdomen as well as limbs.

In a total of three or four minutes devoted to producing counter-irritation at each sitting the electrode must be withdrawn at short intervals of about 15 or 20 seconds in order to

relieve the patient from discomfort; then applied again and thus repeated until the effect is complete.

In chronic cases symptomatic relief of pain and some functional improvement and sense of well-being will be rapidly obtained by this method without any disrobing of the patient. I have found the clinical results more satisfactory to the patient than the more tedious methods which employ either galvanic or faradic currents. A radical cure is probably not to be expected.

Faradization rouses the functional activity of viscera. In diverted or obstructed bile, with clay stools, yellow eyes and skin and high-colored urine, no more effective treatment exists. Unless there is a firm impaction this will at once restore the flow of bile to the proper channel, as the next stool will show. The same application may be made to the spleen, pancreas or either end of the stomach. In this method of faradization we have one of the most powerful and safest of splanchnic stimulants. In biliary colic it will expel the inspissated bile and cut short the attack. In all the many forms of hindrance to visceral secretion it will be found an effective, safe and welcome substitute for mercury, podophyllum, etc. (*Hutchinson.*)

CHAPTER XXXIX.

TREATMENT OF PAIN.

Varieties of pain relieved by static electricity, by the breeze and its modifications, by sparks, and Leyden-jar currents. Relief of pain by galvanic currents. Relief of pain by faradic currents. The relief of anomalous pains by electrical sedation.

In the consideration of any of the single symptoms of disease pain will be accorded the chief place of importance, by the invalid at least, if not always by the physician. One writer divides pain into six different forms as follows:

Pain due to inflammation.

Pain due to pressure.

Pain due to stretching.

Neuralgic pains.

Subjective pains.

Cutaneous pains.

This classification presents little clinical usefulness, but the patient will generally desire curative relief from pain when it can be obtained, and palliative relief when nothing better is possible.

For the relief of pain occurring without evident diagnosis of the cause, or when not affected by treatment of the cause, or when the cause is removed and the pain persists, or when the condition is incurable, the resources of medical electricity are many and various. No exact directions can be given in advance to cover all cases, but the conditions of each case pre-

sented to the practical physician will suggest the method most likely to relieve, and if one method fails another may be tried. The skill which comes with experience will usually select intuitively the most successful form of application.

Whenever any form of electricity will palliate any incurable pain it possesses the enormous advantage over morphine, antipyrin, and other drug anodynes that at the same time it is giving temporary relief it is also imparting a general nutritional benefit.

In other cases of chronic pains in which the anodyne action of drugs most commonly employed is not only non-curative but ultimately harmful to the patient, the fact that some form of electrical current—galvanic, faradic, or static—may be administered with both curative and tonic effects is a decisive argument in its favor. The study of the control of pain is one of the most interesting in electro-therapeutics.

Static electricity is a great pain-reliever. It will temporarily comfort almost any pain that can attack the living tissues, but its curative efforts relate to pains of well-understood character. It will rarely stretch beyond its own indication and permanently cure a pain to which it is not suited. When it fails the galvanic current is often indicated. When these, singly or together, fail to cure pain, and in common with all other measures prove to give but temporary relief (as often in locomotor ataxia and cancer), they are blessed palliatives to the patient, for, unlike drug pain-destroyers which also destroy vitality, electrical currents build up the forces of nutrition.

The great sphere of static electricity by insulating methods relates to the nervous, circulatory, and muscular systems. It is not well suited to pains within bones, cartilage, deep viscera, and between articulating surfaces. It must act upon tissues within which it can exert its limited effects, and a careful consideration of the action of static electricity in painful affections will repay every student of the materia medica.

In its form of general positive electrification it very often

corrects those general, undefined, and mild expressions of pain which accompany slight constitutional disturbances.

It evidently does this through its tendency to regulate functional processes, to disturb disorderly atoms and rearrange them in better order, and to "assist nature to restore the sound state." It summons together the broken ranks of the nerve forces and influences them to march all one way; but it does not always succeed in holding them together permanently by one dose of ten minutes when reactionary forces are obstinately established. Therefore a repetition of treatment is required.

There is an old experiment which shows that when tadpoles are swimming about in a basin of water and a galvanic current is passed through the fluid, the tadpoles instinctively fall into line and swim agreeably in the direction of the current flow. I believe that some influence similar in character is exerted upon the ultimate particles of the protoplasm of the human body during the passage of an electrical current, and that the tendency of static electricity to regulate to normal action all varieties of functional derangements is explained in this way.

The energy of current action is dependent on the *rate of change*. This rate is greater with what is called a large dose than with a so-called mild dose; it is greater in any part through which the current is localized than it is through the same part when the application is general, and it is greatly increased when the localization ceases to be convective merely, and becomes disruptive.

Students of galvanic electricity will remember that the ampère is the unit of the rate of galvanic current flow, and that the number of milliampères obtained as a medical dose in proportion to the effect desired expresses simply the rate of current flowing through the tissues. The dose increase therefore of ten, twenty, fifty, or a hundred milliampères indicates the increase of intensity of action through an increase in rate of motion. Rate of movement is an equally important factor in the

practical work accomplished by all currents of water, air, or electricity.

In static electricity the *rate* is still the all-important element in therapeutic work, although not one physician in perhaps a thousand has ever had his attention directed to this rudimentary fact.

It is for this reason that large Holtz machines are more efficient than smaller ones. In administrations of a powerful static current the rate of change is least when the discharge from the insulated patient is restricted to general diffusion into the atmosphere, but every form of local application has the effect of quickening the rate of change through the powerful attraction of an opposite potential force.

The static breeze upon the head or spine is simply an immensely quickened rate of electrical change through the tissues in near relation to the discharging electrode, and consequently it increases the work done in the tissues upon the same principle that an increase in the rate of flow over a waterwheel will increase the amount of work done in the mill which it affects.

The limitations of the character of the physiological work done by static electricity are well known. It does not attack connective-tissue new formation or structural changes; it does not perform chemical electrolysis, or reorganize living tissue from the ashes of the tomb; it does not destroy specific disease germs, nor does it exert a marked influence upon the inorganic matter of bones; but acting as it does in its own way as set forth in the chapter describing its known properties, it is one of the most certain, definite, and effective remedies known to the materia medica.

The anodyne effects of the static breeze are not produced by local anæsthesia. They do not benumb. They act, so far as they are either temporary, or become permanent by repeated doses, by changing disordered sensation into orderly and normal sensation.

The static spray goes a step beyond this because it adds still more intensity to the rate of change and the local concentration.

Sparks go beyond the spray, for they bring the rate of change, however rapid it may have previously been, to an instanteous climax of wellnigh inconceivable rapidity by a complete disruptive discharge. They therefore abolish pains that refuse to budge for the coaxing of simpler methods.

If a patient who is positively charged will hold out a finger toward the negative prime conductor and attract a single long spark, he will find that it benumbs and dulls the sensation of the nerve filaments of a healthy finger-tip. When a number of such sparks are applied to a painful part they not only intensify the rate of change, and thus produce a maximum of physiological effect which is dependent upon rate, but they temporarily benumb the sensory nerve filaments wherever they strike a blow. The capabilities, therefore, of static electricity in relieving pains through the agency of modifying or increasing the rate of change cover a wide range of clinical practice; and when we add to these capabilities of the breeze, spray, and spark the mechanical effects of Leyden-jar currents, which cover the whole range of external applications of faradic currents, we must accord to static electricity the most diversified usefulness of any single agent in therapeutics.

The Breeze and Its Modifications.—Applied with proper reference to polarity and the seat of pain, the static breeze will relieve at once, and gradually cure, headaches not due to a persistent cause elsewhere, or a tumor, or condition within the head which external treatment will not reach—such, for instance, as the pain of a middle-ear abscess.

In headaches of nervous and circulatory irregularities, anæmia, congestion, insomnia, anxiety, overwork, menstruation, study, rheumatism, gout, neuralgia, cold, general debility, cerebral neurasthenia, and reflex headaches that linger after their cause has been removed, and cases of allied nature, the satis-

factory relief it speedily affords at the first application becomes permanent nearly always after sufficient treatment.

When disordered functionation manifests itself by sore and bruised feelings in the soft parts, the positive static breeze concentrated to almost a spray restores the normal circulatory state and produces comfort.

The static breeze relieves the headache of cachexias for periods varying from a few hours to several days after a *séance*, and is thus a useful adjunct to medication.

It does not cure specific pains; it will not give satisfactory relief to bilious headaches until the gastric disturbance is corrected; it may fail or succeed in severe neuralgias about the head; and every once in a while a patient will appear with a stubborn headache which baffles alike a satisfactory diagnosis and satisfactory treatment.

The head pains treated by the static breeze must be properly selected, but when this is done the remedy is very efficient.

The static breeze also relieves the pains of dermatitis, bruises, sprains, the soreness of excessive muscular fatigue and strains, local aching conditions in muscles, neuralgias near small joints or bony structures covered with little muscle, acute congestions and local or glandular inflammations, the pains of a bunion, a toothache, and the sore bruised gums left by the dentist after he has either filled teeth or pulled them out.

Acute pains due to conditions which require gentle and soothing comfort are well treated by the static breeze.

Painful chronic states which are best treated by counter-irritation or muscle stimulation are well treated by either the concentration of the negative breeze into a strong spray or by short friction sparks.

Sparks.—When the character of the pain denotes that something in the tissues needs forcible driving out, the spark is called for and the breeze is inadequate.

The particular pains relieved by static sparks are localized within muscles, fascia, and nerve sheaths.

The spark is of immense value for painful conditions below the neck, but it is not suited to pains caused by the distortion of nerve filaments within contracting cicatricial tissue or a bone callus; or pains of deep visceral neuralgia, of acute congestions and inflammations, and pains deep within joints and bones, due to diseases of the bones.

In some cases the character of the pain comes within the action of the spark, but the site of the pain is in such relation to sensitive tissues to which the spark could not be applied with comfort, that we adopt other methods by preference.

The great sphere of spark action is upon and within muscles. When exudation pressure, or the circulation in the system of irritants, such as an excess of uric or lactic acid, or the products of waste, set up pain, the spark is indicated, as well as in almost all cases of chronic inflammations, congestions, and neuralgias. The spark can usually be modified in force with a little operative skill to fit the part and to fit the pain, and will control a great variety of reflex, functional, and neurotic symptoms of a painful character.

In all the large class of pains which are called rheumatic the spark is *facile princeps*, especially when there is chronic inflammatory exudation locked up in unyielding muscular fascia and nerve sheaths. The strong spark will cause this exudation to move on and out by a process very similar to the principle of the circulation of blood in the veins and the circulation in lymph vessels.

Leyden-Jar Currents.—These static currents applied with moist electrodes in contact with the body relieve pains to which the faradic currents from high-tension induction coils are also suited and are usually employed.

These pains are chiefly of the muscular character which the spark also relieves, but the high potential small-jar current oscillating with extreme rapidity will also act upon pains deep within joints, between articulating surfaces, in the trunk of the

body, and the acute localized congestions, bruises, burns, etc., which the breeze benefits.

An ordinary sponge-covered electrode moistened with hot water is placed directly over the site of pain and connected with the positive Leyden jar. A similar electrode connected with the negative jar is placed so that the current will pass directly through the tissues affected with pain. The sliding poles of the machine are then brought together till they touch, and when the machine is started into rapid action the dose is regulated by pulling the poles a little apart until the current strength produces sedative relief without passing beyond the point of comfortable tolerance.

As these applications require the removal of clothing upon the main portions of the body, they yield in practical importance to the more commonly used methods.

Constant Galvanic Current.—The galvanic current possesses remarkable power over pain. The general principles which govern its application when not especially directed by other conditions are as follows:

1. The positive electrode is placed over the site of pain in acute hyperæmic cases, or the negative electrode is placed over the site of pain in chronic and anæmic cases, with the indifferent electrode at any convenient point.

2. The electrodes are placed above and below the site of pain.

In the one case the local polar effect is chiefly sought, while in the other case the interpolar action is deemed indicated in the absence of any special polar indications.

The size of the electrodes must be suited to the situation and nature of the pain. If diffused, apply large felt-covered, flat electrodes and large currents. If sharp concentrated pain is present use small electrodes in proportion. In acute and congestive conditions use only a small amperage. In opposite states large currents will often relieve when small amperage fails, and in deep visceral pain clay electrodes with the greatest dosage that can be safely passed through the skin and applied

for long sittings may give relief when nothing else is successful.

In localized neuralgic pains chloroform and cocaine cataphoresis may be employed. Owing to the desperate nature and obstinacy of pain upon some occasions the patient will welcome any means that will give relief.

Faradic Sedation.—High-tension induction coil currents from improved apparatus, sinusoidal machine currents and static induced currents possess about the same pain-relieving properties. The method of applying them is alike. As the coil apparatus is the one almost universally employed it is used for the relief of pain in the following manner:

Place the positive electrode over the site of pain with the negative opposite or at the most convenient point near by. Select a negative electrode somewhat larger than the positive. Moisten both in hot water. Switch into circuit the long fine coil, the rapid vibrator very smoothly adjusted and sufficient E. M. F. The number of cells required will depend upon the size of the electrodes and the sensitiveness of the tissues, but in the author's improved apparatus the secondary rheostat controls all currents perfectly from zero up to tolerance, and therefore an ample number of cells may be employed in all cases.

Fig. 346. Felt or sponge covered flat electrode, assorted sizes.

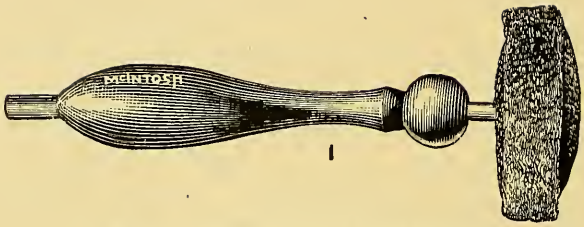


Fig. 347. Sponge-covered hand electrode.

Gradually increase the current strength from zero until it produces the effect of controlling or nullifying the pain. The impression upon the pain may be quickly or somewhat slowly produced in different cases. As the strength of the current appears to diminish (evidence that sedation is progressing) gradually increase the dosage a little more and maintain this until pain ceases entirely. Continue the application for about three minutes longer and then gradually reduce to zero.

For the relief of pelvic pains by the bipolar method the reader is referred to the sections devoted to gynecology. In considering the relation of what used to be called "faradism" to pain the reader must discard about all that he has ever read on the subject by writers who have employed only the common faradic battery. The improved high-tension induction coil current smoothly interrupted with intense rapidity is so great an advance upon the old-time faradic apparatus that it finds among its chief uses a great many conditions from the treatment of which "faradism" was formerly debarred. Acute congestions and inflammations are examples.

Examples of the Relief of Anomalous Pains by Electrical Sedation.—Mrs. ——, aged 43, has had a right-sided pain since early childhood. She refers it to the lower border of the liver. It is a general diffused, burning pain, recurring without apparent cause, lasting for several hours or even days at a time and then ceasing for an indefinite number of days. The intensity varies from a mere annoyance to a disabling agony which compels her to go to bed.

It has never yielded to any form of treatment. No satisfactory diagnosis of the cause has been made by any physician consulted either in New York, Paris or London. In 1890 a well-known diagnostician pronounced it a case of floating kidney, but others disagreed. Pelvic causes were excluded by competent gynecologists, and it is needless to say that the patient declines any uncertain surgical interference with her general health, which is good.

In cases of this kind electrical currents lend themselves powerfully to the aid of the general practitioner without regard to uncertainties of diagnosis and failure of drug treatment. It is obviously injudicious to establish the habit of taking anodynes. For the past two years this patient has obtained comfort in the following manner:

When the paroxysm of pain appears a felt-covered, flat electrode, 7 × 10, is saturated in the usual hot-water solution of bicarbonate of soda, connected with the positive pole of the galvanic battery and placed over the anterior region of the pain. A similar electrode is connected with the negative pole, placed opposite the positive electrode on the back, and a constant galvanic current, gradually increased through the rheostat from zero up to 25 mil., is passed directly through the tissues.

The patient reclines comfortably upon a couch, and the anterior electrode is kept in firm contact by the weight of a small shot-bag. The electrodes remain in position without requiring any attention on the part of the operator until relief is complete. This has sometimes been accomplished in a short sitting and at other times the pain has been more severe and aggravated, and has required between 30 minutes and an hour. One or two applications put an end to the attack until the next one occurs, and the intervals between attacks appear to be growing longer. In this case relief is not afforded by either the faradic or static currents or the opposite polarity of the galvanic current.

Mrs. ——, age 70, in 1836 was injured in region of left knee-

joint. Since then—a period of sixty-one years—the lower part of the femur for three or four inches above the knee anteriorly has felt as if the "bone was bruised." It is tender to pressure and the limb has always been weak. The vicissitudes of a long life and varied health witness little or no change in the condition of this sensitive area. It was never affected by medical treatment. Cramps in the calf of the leg were a frequent and chronic occurrence.

In treating this case with static electricity for another condition I also administered at each *séance* a few mild positive sparks to the site of the "sore" bone and to the calf of the leg. The tissues were exceedingly tender to the direct blow of the spark, but it not only set up no aggravation, but gradually gave relief, so that after daily treatment for a week she had no more cramps, could walk with greatly increased energy and the bruised sensation and tenderness of the femur was no longer noticeable.

Mrs. ——, age 41, a stout woman, apparently in sound general health. Fourteen years ago felt an aching sensation in left foot. Since then, with a gradual increase in severity, she has been subject to sudden paroxysms of pain commencing in the joint of the third toe, extending up the limb, and at the same time affecting the third finger of the same side and extending up the arm.

The pain is of a peculiar character and without external manifestations. She has consulted specialists in gynecology, nervous diseases, gout, rheumatism, etc., who have differed as to diagnosis. She has found all treatment unavailing, and treatment has included specially fitted shoes, baths, travel, diet, massage and the medical prescribing of a number of physicians. Whether the pain was neuralgic, gouty, rheumatic or not, made in this case no difference to the effective application of electricity. She was given total relief at each sitting by mild positive spray and sparks, together with general tonic static electrification. Relief lasted longer and longer after successive treatments, and after a couple of weeks

she passed an entire month without any pain whatever for the first time in several years. The final result was decided improvement without a complete cure, but as she had previously discarded medical remedies and was satisfied with the degree of comfort obtained she ceased to attend. Galvanic and coil currents both failed in this case.

CHAPTER XL.

TREATMENT OF HEADACHES.

The local treatment of pain in the head. Constitutional treatment by static electricity. Galvanic and faradic methods. Hemicrania. Migrane. Anæmia and congestion of the brain.

For the relief of headache during an attack static electricity in the form of a breeze or spray directed upon the part of greatest pain is an efficient measure in congestive and nervous headaches and some others.

The local treatment of pain in the head is perhaps the least important part of the influence which all forms of electricity exert in the relief and cure of headaches. The symptom is so common an accompaniment of derangements or disease elsewhere than in the head that local treatment is curative in only a very small proportion of the cases that come to the office of the electro-therapeutist who employs cell and coil currents alone.

During the treatment of the cause the headache in most cases is permanently relieved or greatly lessened. This is especially true in the use of the galvanic and faradic currents, but in the use of static electricity practically every treatment is constitutional as well as local, and if headaches are habitual or are present at the time of treatment the same administration that relieves the pain tends to promote the permanent cure.

As there is but very little difference in the form of applications to the head, the separation of headaches into thirty or forty different varieties is of value only so far as it relates to the probable prognosis.

Some headaches will be rapidly relieved by static electrification, and if benefit is maintained by a sufficient course of treatment it will gradually become permanent. These headaches are those which arise from functional disturbances of the nervous and circulatory systems and the pelvic organs and perversions of nutrition.

Some headaches which are a symptom of diseases which are amenable to benefit by static electricity will also undergo gradual improvement while the disease is being treated. The headaches of rheumatism, gout, malaria, and some kinds of dyspepsia belong to this class.

Severe head pains which are due to grave or chronic disease, or pressure within the cranium—causes which the static current cannot directly affect—may often be mitigated in their severity. It is obvious that a very great advantage of static electricity over the "headache powders" now for sale in popular dry-goods stores and on all druggist counters without the formality of a competent physician's advice is the decided general benefit which it imparts whether it palliates or cures, and that in no case is it liable to do any harm whatever. When the anæmic victims of habitual and severe headache resort to "powders," which they buy as common merchandise, and take with twofold ignorance of either the nature or the action of the drug, the consequences may be oftentimes disastrous. It is certain that many people injure their health in this way.

If the patient is receiving other electric treatment and has a headache at the time, the method of relief will be the application of some form of breeze upon the area of pain.

This may be the frontal region, the vertex, one or both sides of the head, or the occiput. If the headache is nervous or con-

gestive, or the scalp feels sore and bruised, or is relieved by cool applications, I consider the positive head breeze indicated, and apply it with the strength regulated to comfort until the headache ceases. This may require five or ten minutes.

If it is a very obstinate ache I have observed that after five or six minutes the sense of relief has only begun to manifest itself and that about double this time will be required for the *séance*. If, however, a state of comfort is not obtained under thirteen or fifteen minutes it has been my experience that the headache was not suited to this remedy. Bilious headaches and those dependent on the dragging of a uterus which needs support are of this character.

If the headache is one which seeks stimulation rather than sedation for relief I employ a negative breeze; but in this case it is much more necessary to employ a hand electrode and keep the breeze in motion if the hair is thick and resisting. A strong negative head breeze from a fixed electrode is well-nigh intolerable to a scalp which is covered with thick hair, but the irritation may be reduced by keeping the electrode in motion or by interrupting the breeze as I have described elsewhere.

Upon the whole, the amount of attention to give headaches—whether to treat them locally or trust to the general treatment; whether to expect temporary relief, partial improvement or a permanent cure, or whether to disregard electricity entirely and prescribe other measures—is a matter for experience to teach the operator of the static machine, and the ground cannot be fully covered in a text book.

I have now a case of a woman, about thirty years of age, who simply sits upon the static platform to hold her infant while the child is subjected to positive electrification for about ten minutes three times a week. She lately informed me that she had had habitual headaches since the age of nine, and that she could remember very few days of her whole life when her head had been entirely free, but she had noticed that she was now

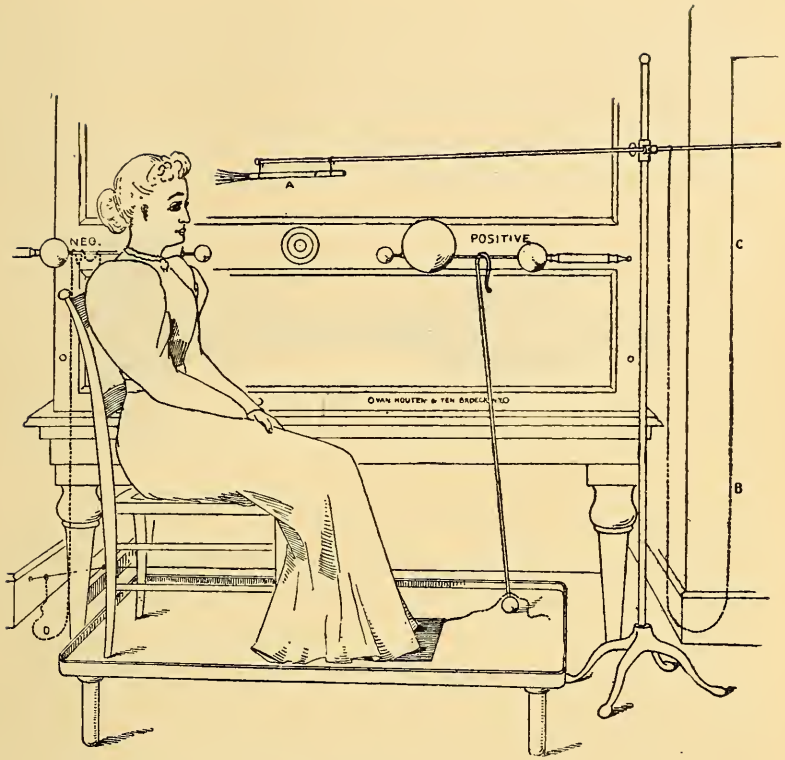


Fig. 348. Sedative breeze to frontal region with positive electrification.

A. Author's copper needle electrode upon standard. B. Chain from standard to grounding. C. Copper wire upon the side wall connected with the gas fixture. D. Grounding chain connected with negative pole. In this application always connect the platform with the positive pole, make direct metallic connection with the patient and place the electrode within about three inches of the forehead.

free from headache more than half the time, and that her head always felt comfortable for the remainder of the day following each sitting.

The curative tendency of electrification is very marked and very persistent, but there are so many causes of headache which are beyond its reach that a reasonable amount of judgment must be employed in deciding whether to treat locally or not.

I have referred to the application of a sedative breeze upon the site of pain, but will here call attention to the great efficacy of a counter-irritant spray or series of fine sparks upon the nerve centres at the base of the brain.

Galvanic and Faradic Methods.—Apart from the general uses of central galvanization and general faradization for con-

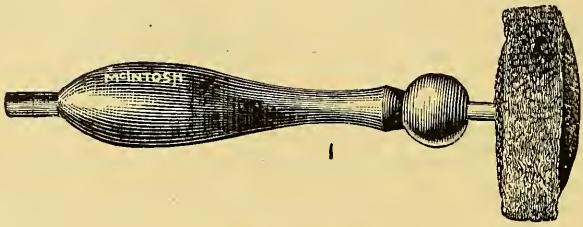


Fig. 349. Sponge-covered hand electrode.

ditions of which headache is a symptom the local application consists usually in placing two electrodes, one on the forehead and one over the lower cervical spine, and passing a mild constant current of about 4 mil. or a rapidly interrupted high-tension coil current. The frontal electrode is usually made positive, but in chronic anæmic cases it may be made negative. Owing to the dependence of headaches upon causes outside of the head, the chief value of electricity is its curative action under persistent treatment rather than its power to palliate the pain during an attack.

Hemicrania.—*Galvanic.*—Apply the positive electrode to the forehead and the negative to the cillio-spinal centre. Gradually increase the constant galvanic current up to four or five mil. Maintain until pain ceases. Repeat p. r. n.

It is generally recommended to also tone up the system by persistent use of central galvanization and general faradization to effect a permanent cure, but these methods are almost out of the question in many cases in office practice, while the employment of the static apparatus is both practical and therapeutically as efficient. Prescribe medical remedies as indicated.

Static.—Seat the patient comfortably on the negatively insulated static platform. Ground the positive pole to the water pipe or gas fixture. Concentrate a positive head breeze upon the site of pain, regulating the intensity to the state of the patient's head and hair. The space between the head and electrode may usually be from twenty down to twelve inches.

Continue head breeze three minutes after all pain ceases at each *séance*. Then apply a general nutritional treatment to the spine and entire body, with the brass point electrode manipulated so as to cause an agreeable glow throughout the system, tone up the heart action, raise the temperature to normal, and dispose of the cold extremities which these patients so often have.

Close the sitting with a few moments of sedative-tonic positive electrification. The total time required for thorough treatment is rarely over fifteen minutes. Repeat daily at first until relief lasts two days. When improvement is established continue three times a week.

In two or three months, sometimes sooner, relief becomes permanent in the majority of cases. The expert operator can hasten the results by attention to the special idiosyncrasies of each case.

If the constant head breeze is felt to be uncomfortable the point electrode swayed in the hand will make it satisfactory. If the hair is thin and the clothing is of neutral fabrics, thin or tightly woven, positive electrification may be preferred to obtain the stronger negative breeze; but in all these cases the choice of poles must be governed by the strength of current given out by the machine.

The head breeze may temporarily relieve the pain at the time of the paroxysm, but curative results depend of course upon regular and persistent treatment for several months.

Along with relief from pain there is a general upbuilding of the patient's health, which will remain of great value to her for a long period, and it is this decided constitutional gain

which adds a peculiar satisfaction to the use of static electricity in a disease in which drugs so often fail.

If complications exist they must of course receive care, but the treatment of migraine itself by static electricity will rarely disappoint if properly carried out.

Anæmia and Congestion of the Brain.—*Galvanic.*—Select two small sponge-covered hand electrodes, moisten them in

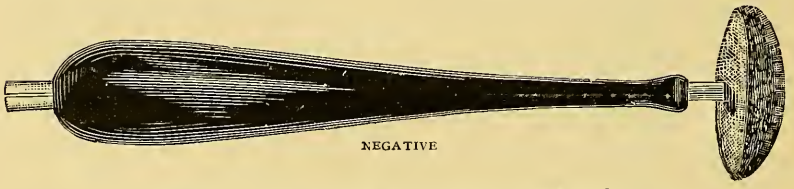


Fig. 350. Ordinary sponge-covered hand electrode.

the usual hot-water bicarbonate of soda solution, press one upon the seventh cervical vertibræ and apply the other to the depression under the ear, generally of the right side. In case of anæmia connect the cervical electrode with the positive pole, and in the case of congestion connect the cervical electrode with the negative pole. Otherwise the technique is exactly the same in either case.

Gradually increase the constant galvanic current from zero up to about 7 or 10 mil., stopping short of producing any disagreeable effects. In about three minutes reduce to zero.

These applications may form part of a plan of treatment with the galvanic current in diseases in which the above conditions appear to demand attention, but they will never be required by the skilful operator of the static apparatus. The regulating action upon the functions and circulation of the entire body during any nutritional treatment with static electricity renders it practically unnecessary to "galvanize the sympathetic," once a very popular proceeding.

Static.—The relief of this cerebral hyperæmia is afforded by the same means as the treatment of congestive headaches. If, in these cases, the scalp is very sore and tender, and even the weight of the hair is felt to be an intolerable burden, the posi-

tive static head breeze will produce immediate beneficial effects. Frequency and repetition of the treatment must be governed by the intensity and persistence of the hyperæmia.

Cerebral Hyperæmia from Loss of Sleep. In 1888, Lieutenant L, 28, was admitted to hospital in consequence of having been on ship duty for five consecutive days and nights. He had paroxysms of cerebral hyperæmia coming on suddenly several times a day, though there was some premonition, such as vertigo and headache. When having such symptoms he could walk a short distance—a half block or so—with staggering gait, but then had to lie down or fall. Upon lying down or falling he would flex his body strongly and become unconscious, and the torpor would be so deep that he could not be waked, but in an hour or so would wake voluntarily and remember what had occurred up to the moment of such sleep. When these spells came on the face became flushed and during the period of unconsciousness cyanosed, but upon waking would resume its natural pale color. Under medication it was found that nothing would abort the paroxysms, but that a large dose of bromide of potassium or soda given promptly when the face began to flush would render the paroxysm less severe, though the after effect seemed to be injurious, as it left him in a semi-torpid condition for some time after the ordinary duration of the spell. After several days' treatment he happened one day, when a paroxysm was coming on, to be in the office where galvanism was accessible, and I quickly applied a current of 5 ma. to head, moving the positive pole over the forehead and holding the negative pole steadily at back of neck, and continued this treatment for five minutes. He experienced immediate relief; the flushing and headache disappeared and the paroxysm was averted.

From this time on the same electrical treatment was given whenever he had any flushing of face or headache, and always with the same salutary effect. In the course of a few days, however, it was found that a *séance* of a minute was all that was required. After two weeks of such treatment the patient seemed perfectly well, but the momentary application of the current was made occasionally, when the patient felt the least anxiety about himself, for some two weeks longer, when he was discharged convalescent, but was advised not to do any mental work for a long period. He, however, soon after resumed his studies, visited Washington and was examined and promoted, and has since been well and in active service. (*Woolsey*)

CHAPTER XLI.

TREATMENT OF NEURASTHENIA—BY STATIC ELECTRICITY.

Simple and symptomatic. Acute or chronic. Static electricity the sheet-anchor of treatment. Operative methods. The treatment of local symptoms in neurasthenic cases. Constitutional benefits of general electrification in neurasthenia. Differential indications. Frequency of treatment. Auxiliary medication. Prognosis. Facility of static methods. Principles governing current action in neurasthenia. Clinical remarks. Crying spells. "Nerves."

The successful treatment of neurasthenia requires the co-operation of the patient with the physician. The sheet-anchor of nerve-renewing force is electricity. Rest must economize and accumulate its benefits, and in some cases appropriate drugs must assist at the start, but the chief part of the work can be done with static electricity. Neurasthenic states, nervous break-downs from mental or physical overtax or insomnia, with either local or general manifestations, present a great many difficulties to symptomatic drug treatment.

Treatment.—In the beginning treatment must often be modified greatly, to initiate the patient rather than to attack the disease. The simple electrification and breeze methods are first to be employed, and if sparks are regarded as desirable they can wait till the patient is ready.

Seat the patient in a comfortable and high-backed chair upon the static platform and in the most restful position for complete nerve composure. The first tentative electrification should be negative and mild if the patient is a stranger and full of unfounded fears.

Attach the negative pole to the platform, ground the positive pole, start the machine into slow action, observe the tension of the hair and the increase of the patient's confidence, and follow this up with gradual increases of the current strength.

In about ten or fifteen minutes close the first sitting. Attempt nothing else. Do not touch an electrode or go near the patient while she is insulated. Let her reassure herself and get some benefit before the next step in advance is undertaken.

Upon the second visit, or at the first, if no particular caution seems necessary, make the electrification positive, but see to it that nothing in the room near the platform exerts an attracting influence to disturb the patient's composure.

Until the patient is prepared by established confidence to let the operator employ electrodes, no local application should be attempted. It is necessary to speak of this because a neurotic patient may occasionally be lost by too much vigor during the first sitting. Personally, I am in the habit of commanding full confidence at the second visit and usually at the first, even with patients never seen before, but only the mastery of practical experience will enable the physician to do this, and it is better to go slow rather than to hasten too fast.

The duration of each *séance* of positive electrification is governed by observing the effects. When the patient perspires freely it is a sign that the stopping-point for the day is reached, provided the diaphoresis is not due to the warmth of the room and the retention of heavy wraps during treatment.

In all cases there may wisely be a gradual advance from short to long sittings, but in saying this it must be noted that the expert can often produce effects in ten minutes that a novice would waste half an hour in securing. Nevertheless a half-hour of restful and restorative simple positive electrification is sometimes the best treatment that can be given.

The next step in procuring a general tonic and active nutritional influence is by the author's method of potential alternation. Begin the *séance* by positive electrification as usual, adjust the brass ball electrode upon the standard and administer the vibratory current, regulated in spark length to a comfortable intensity, for ten minutes longer; then close the sitting with any local applications that are required.

By this time, in the majority of cases, the gain in nerve composure, sleep, well-being, appetite, and spirits is manifest. The patients now eagerly crave the static bath and spontaneously look to it as the means of restored health. Its benefit is self-convincing and no assurance that it will do further good is needed; the stanchest advocates of static electricity are the patients themselves.

We are now ready to attack local symptoms with the brass point breeze electrode. Do not begin with sparks unless you know your patient, know the spark action, and have confidence in your skill; for sparks are somewhat energetic in irritable nerve states, and they should be known to be necessary before they are used.

The first attempt of the breeze should be made with negative electrification. Stop the machine, remove rod from positive pole, transfer it to the negative, and ground the positive pole and breeze electrode. I pay no strict regard to whether the neurasthenia is cerebral, spinal, sexual, or to any other limiting diagnostic phrase. I consider the patient "sick all over" and treat her or him accordingly with the most thorough constitutional administration possible. Upon this general benefit I engraft such local benefit as symptoms call for. This is practical medicine as opposed to text-book theory.

To culminate the constitutional benefits of general elecrification I close the sitting or begin it, either one, with the most complete sedative, or sedative-tonic, or stimulating-tonic, or even counter-irritant effects I can produce with the point electrode, with either positive breeze or spray, or negative breeze or spray, or rubbing frictions, as these in turn are indicated and as the case is ready to receive the application.

During the use of this electrode it requires but a little time to concentrate upon an aching, congested, irritable, or painful point of the spine, head, pelvic region, perineum, muscle group, hands, arms, legs or feet, the localized effect that the condition calls for.

Upon the vertex, forehead, or the base of brain, headaches or congestions in these regions take more time to relieve by sedation than is required to stimulate nutrition in other local parts, and I therefore usually complete the application by a positive breeze from a fixed electrode directed toward the one of these situations which causes the complaint.

When a quick cutaneous and reflex stimulation can be beneficially applied to either the local part of an aching spine or to all the muscular surface of the back and extremities, this can be done by friction sparks in two or three minutes or less without removing a garment. The effect differs markedly in sensation from general faradization but in lasting results it is not less efficient and takes about one-fifteenth of the time and trouble.

This counter-irritant and stimulating effect is produced by a very quick rubbing of the large brass ball electrode over the surface of the clothing in close contact with the patient. With negative electrification it is less sharp and hot than with the positive high-potential charge, but in either case the novice should try it on himself and learn how to consult comfort before he rashly ventures to treat a patient with this profoundly revulsive and intense application.

When improvement has proceeded so that the strengthening of muscles can be begun by the use of sparks, or their deep-acting effects applied for other needs, they should always be mild positive sparks given at the latter part of the *séance* and increased in vigor with some prudence.

All these needs for caution cease to a great extent as soon as improvement is well under way. The patient will gladly welcome treatment as soon as she discovers its benefit, and the timidity of the period of strangeness vanishes forever.

In clinical experience I find that patients who attend three times a week, receive no medical aid, and who return to their ordinary household duties, derive great benefit from static electricity alone; but they do not get rapidly and permanently well

in chronic cases, especially if they come a fatiguing journey to reach the office and repeat it going home. They spend strength at home as fast as they made it during treatment, and about all that can be done is to keep them able to do more work than they did before. In even these cases, however, static electricity does what medicine, as usually prescribed, fails in doing.

In private practice, with appropriate medication, daily treatments, and auxiliary rest, the results are far more satisfactory. In acute states the recovery is quickly brought about. When relapses occur from imprudence the gain goes on again at the next sitting; when fresh symptoms develop they may each be relieved during the sitting without special prescribing, and it is this fact which constitutes one of the most gratifying features of the treatment of neurasthenias by static electricity. As soon as sleep improves through the aid of breeze and spray upon the upper spine and head, the whole system marches forward to a general improvement, for there is no restorer like refreshing sleep. The great nerve centres to which the physician is accustomed to address himself in central galvanization are equally important under static methods and the principles of affecting them are precisely the same.

Clinical Remarks.—From the fact that no removal of clothing is required and the patient derives an immediate benefit at every *séance*, static is preferable in practice to other forms of electricity in the treatment of neurasthenic patients.

The aim of intelligent treatment of neurasthenia with static currents is to make a sustaining, tonic impression upon the whole system. The methods involve general positive electrification and localized nutritional, alterative, function-regulating impressions upon the cranial and spinal centres and sympathetic system, and the motor-nerve supply of muscles, by the local concentration of current action upon the head, spine, and general surface of the body through the medium of the breeze and spark electrodes.

In these cases, as in all others, the physician must know his

electro-therapeutic target and how to aim at its centre. It will not do simply to apply in a mechanical manner "as directed" a breeze or spark or any other form of electrical energy.

It is essential to determine what effects are required, know how to produce these effects, and proceed with definite and positively applied methods to "round up" the errant nerve forces and reform their shattered ranks. They must be coerced into line and drilled again into effective action, and no perfunctory requests on the part of the operator will ever equal in result the effect of sharp and decisive commands. If anything is to be expected of static electricity in cases that have perhaps already gone the rounds of the neighborhood profession without relief, the operator must produce his results as Turner mixed his colors: "with brains, sir!"—for the Holtz machine will do little for a patient automatically.

It is necessary to say this plainly because an opinion prevails in some quarters that any electric current can be injected into the body in any sort of way, and either cure disease by accident like magic, or in other cases prove to be no good at all. Static electricity, within its legitimate sphere of action (see chapter on its physiology) will do what the skill of the operator makes it do, and seldom any more.

It is usually necessary to call a halt to further waste of nervous substance, aid the elimination of toxic products of fatigue and incomplete metabolism, and establish and maintain the highest possible nutritive activity.

To accomplish these things brief and infrequent treatment is disappointing. The nutritional and nerve-refreshing banquets of electrical energy must be fed to the nerve centres and the asthenic tissues to the extent of a "saturated solution" at each meal; and repeated often enough to maintain each nutritive gain, add to it, and put benefit upon benefit, on the same principle that food nourishment is forced in cases of emaciation.

It is certain that when the intervals between electrical doses are so long that the first benefit overpasses its maximum and

dies completely away before the second is administered, that the patient will stay very near the starting-point and make but slow advances toward the distant goal of health.

The state of nervous prostration may be due either to swift or gradual exhaustion, worry, starvation, or toxæmia of the nerve centres, but, however caused, I believe that the joint use of galvanic and static methods, together with sensible hygiene and accessory medication, constitutes the best-known treatment of neurasthenic patients.

The rest cure and massage are popular methods of treatment for neurasthenia, but the patient is indeed unfortunate who misses static electricity. Properly managed it is from fifty to five hundred per cent more satisfactory than routine treatment without it.

Neurasthenia has been said to constitute "a whole family of functional disorders." It is also said to be "at once the most frequent, most interesting, and most neglected disease of modern times." It may also be stated that static electricity, with the help of reasonable medication if not quite single-handed, will cure every curable case, provided the patient will submit to regular and systematic treatment.

The study of "nervous prostration" or "nervous exhaustion," "nervous debility," "weakness," "nervous dyspepsia," or neurasthenia under any of its many names is essentially a study of symptoms which are of the nature of functional derangements.

The characteristic effects of static electricity in the regulation of perverted functions are well known to all who employ it. The late George M. Beard presented a comprehensive list of the symptoms of neurasthenia in his work upon the subject of nervous exhaustion. It is impossible to peruse this familiar list without a profound appreciation of the single remedy which will conquer almost every one of Beard's hundred and fifty symptoms and give comfort to the afflicted patient.

No detailed instruction for the treatment of each symptom of neurasthenia can be required by the physician who studies

this book as a whole, for the general principles of treatment are carefully laid down. It is eminently suggestive, however, to group before the eye these collected symptoms of "the most frequent of modern diseases" so that we may know exactly what the static machine is capable of doing for its relief.

This remarkable list is as follows:

Symptoms of Nervous Exhaustion (Beard).—Tenderness of the scalp; cerebral irritation; dilated pupils; sick headache and various forms of head pain; pain, pressure, and heaviness in the head.

Changes in the expression of the eye; congestion of the conjunctiva; disturbances of the nerves of special sense; neurasthenic asthenopia; muscæ volitantes.

Noises in the ears; atonic voice; deficient mental control; mental irritability; hopelessness; morbid fears; astraphobia, or fear of lightning; topophobia, or fear of places; agoraphobia, or fear of open places; claustrophobia, or fear of closed places; anthropophobia, or fear of society; monophobia, or fear of being alone; phobophobia, or fear of fears; mysophobia, or fear of contamination; pantaphobia, or fear of everything.

Flushing and fidgetiness; frequent blushing; sleeplessness; bad dreams; insomnia; drowsiness; tenderness of the teeth and gums; nervous dyspepsia (dyspepsia asthénique); deficient thirst and capacity of assimilating fluids; desire for stimulants and narcotics.

Dryness of the skin; abnormalities of the secretions; abnormal dryness of the skin, joints, and mucous membranes; sweating hands and feet with redness (palmar hyperidrosis); salivation; tenderness of the spine (spinal irritation) and of the whole body (general hyperidrosis); coccyodynia; peculiarities of pain in the back.

Heaviness of the loin and limbs; shooting pains simulating those of ataxy; podalgia (pain in the feet); tremulous or variable pulse and palpitation of the heart (irritable heart); local spasms of muscles (tremors).

Dysphagia (difficulty in swallowing); convulsive movements, especially on going to sleep; cramps; sensitiveness to weather; sensitiveness to cold or hot water; sensitiveness to changes in the weather.

Localized peripheral numbness and hyperæsthesia; a feeling of profound exhaustion unaccompanied by positive pain; ticklishness; vague pains and flying neuralgias.

General or local itching (pruritis); general and local chills and flashes of heat; cold feet and hands; nervous chills; sudden giving way of general or special functions; temporary paralysis; diseases of men (involuntary emissions, partial or complete impotence, irritability of the prostatic urethra); diseases of women. Oxalates, urates, phosphates and spermatozoa in the urine. Gaping and yawning; rapid decay and irregularities of the teeth.

Crying spells.—In many cases women and young girls find themselves in tears with very small provocation. This is true of cases totally devoid of hysteria but who are very neurasthenic. It is a very mortifying infirmity to the patient, but one for which she would neither seek a medical remedy, nor as a rule would the physician prescribe except upon general principles.

In cases of this kind the tonic and nutritional effect upon the nervous system which is needed to combat and hold back the easily flowing tears is obtained within the first week of treatment by static electricity. Whether the condition is associated with simple debility or neurasthenia or hysteria it makes no difference in the method of treatment, which proceeds upon the plan outlined for the treatment of the general condition in the remarks upon neurasthenia.

"Nerves."—Either about the time of an approaching period or when subjected to some social or domestic strain, an otherwise well woman is apt to feel "all nerves, and as if she must fly," while the jaded head of a large family may almost feel desperate enough to "run away and never return."

Seat such a woman in a reclining-chair upon the static plat-

form. Connect it with the positive pole. Ground the negative pole and request her to close her eyes and compose herself for a siesta. Start the machine into a sufficiently rapid action to maintain a vigorous current for fully twenty minutes, and the nervous system will be called away from its distractions and receive a new invoice of strength and rest.

If the patient has been treated before and is accustomed to the method she will also desire a refreshing spinal breeze. If she is in ordinary health this single administration will suffice for another month or until she gets out of sorts again. If she is worn out with household cares a couple of months' regular and frequent treatment by the same method would cost her husband a great deal less than a trip to Europe and would do her about as much good. Potential alternation is a superb remedy also for these cases.

Sound general health is rarely associated with chronic disease of the uterus. If any patient is below par she needs general as well as local improvement. As an auxiliary to the pelvic uses of galvanic and faradic currents, the nutritional and tonic effects, the sedative, nerve-composing, pain-relieving and muscle-strengthening properties of static electricity are invaluable to the patients of the gynecologist.

In the backaches of women, in simple dysmenorrhœas, at puberty, during gestation, throughout the menopause, in neurotic disturbances, neuralgias, headaches, cold extremities or hot flashes, prolapse, endometritis, fibroids, with all their pains and reflex symptoms, in the anæmias, neurasthenias and dyspepsias of these states, static electricity will add immensely to the benefits of local treatment, and single-handed will provide an amount of comfort for invalid womanhood which medical means cannot equal in any other single way.

When it is a nerve sedative it is not a depressant of nerve force; when it relieves pain it does not cut down vitality or engender a narcotic habit. When it tones up the strength it does not awaken an insidious appetite for stimulants.

It can deal with a dozen symptoms as well as with one, and

obviates complications of medical prescribing; and inasmuch as no disrobing is required the satisfactory therapeutic result obtained by static electricity in the states which accompany the pelvic diseases of women is reinforced by the facility of its administration. It speedily gains a prominent place in the grateful regard of invalids who have enjoyed a veteran's experience with other procedures of gynecology.

CHAPTER XLII.

BRAIN-FAG AND INSOMNIA.

Brain-fag, acute or chronic. Refreshing effects of static electricity. Technique of methods of treatment. Value of static electrification to professional brain workers. Chronic cerebral exhaustion. Acute neurasthenic insomnia. Chronic insomnias. Importance of improving nutrition. Successful treatment by electric currents. Four chief methods. The technique of static treatment. Prognosis.

WHENEVER overwork, mind strain, worry, literary labor, the competitions of business men, the anxieties of the physician, of a lawyer over the preparation of a case, of politicians in an exciting campaign, the tax society women undergo, or the monotonous routine of school-teaching, sets up an exhausted state of mind, there are two reparative and essential necessities—restorative nutrition and sleep. Static electricity promotes both of these.

Its immediate sedative-tonic effect is exceedingly refreshing to jaded nerves. When the restless mind refuses to obey the will and voluntarily to rest, this potent function-regulating force seizes upon the irritable and exhausted nerve cells and quiets them into the needed state of composure. The "fidgets" and fatigue disappear, and nature is given an opportunity to resume her tranquil and normal workings.

If the physician so desires he can disrobe the patient and employ the small Leyden-jar current with a negative foot-plate, passing a positive sponge electrode in turn over the surface of the body as in general faradization, which this method

reproduces. This imparts a feeling of lightness, buoyancy, and mental and physical refreshment that no drug sedative or tonic can approach. The patient is ready to seek a couch and enjoy a comfortable nap immediately after the *séance*.

The quicker method, which is practically superior to the other because it requires no removal of clothing and takes much less time, consists of positive electrification, or potential alternation, for a sufficient time to rest the patient perceptibly, followed by a strong negative spray upon the entire spine and especially concentrated upon the cervical, cerebellar, and lumbar centres.

If vertex or frontal sedation is also indicated by the complaints of the patient, a fixed electrode can apply a positive head breeze for five minutes, or the author's form of frontal breeze with an interrupted current and positive electrification for a few moments.

If the muscular system is relaxed from want of exercise and by sedentary indoor occupation, the massage effects of mild positive sparks upon the principal groups of muscles will close the *séance* most effectively and impart a sense of renewed strength and exhilaration.

In acute brain-tire under the stress of a great but temporary task this application will either speedily restore rest at the end of toil, or, if applied daily during the tax of mind, will support the powers, offset nerve waste, clear out the clogging cells, and keep the forces at their highest working pitch. To many professional men during trying emergencies the static machine would be a welcome boon if they were made aware by physicians of its existence.

In chronic cases accompanied by anæmia and general neurasthenia the restful and nutritional action of electricity is more than ever indicated for the patient, but improvement will be much slower. If the applications of static electricity in chronic cases can be made daily for a few weeks and can be accompanied by reasonable rest, outdoor diversions, and suitable hygiene, the

juncture of such practical therapeutics will produce the happiest results.

Many a prominent and brain-fagged clergyman and business man would benefit by this simple method. I have in mind as I write these lines two notable instances of breakdowns in New York pulpits, with reports of unsettled reason, and an after history of long travel in search of rest and health with but half success. Faraday himself broke down from overwork and never fully recovered, although he spent two years in quiet retirement. To these cases static electricity is fitted with peculiar and gratifying efficiency. Active brain-workers in all fields of intellectual excitement and business competitions would do well to obtain a short course of static treatment two or three times a year in advance of any threatened breakdown, for an ounce of prevention is worth a pound of cure, and few cures are more tediously obtained than that from mental collapse.

It is, however, a common experience to find that these important citizens of our commonwealth, whose brains are in the highest degree valuable to themselves and the community, and who are most liable to brain-fag, invariably consult a practitioner whose knowledge of electricity is a combination of misinforming reading and practical ignorance. Some prejudice is frequently added in the physician's mind, so that he either advises the patient that he needs nothing but "rest," or audaciously advances the conspicuously false information that he is "too nervous already, and that as electricity is only a stimulant it would do him more harm than good." Some day, when all medical colleges teach in a thorough manner the simple facts of electro-physiology along with the general facts of drug physiology, physicians who figure as specialists, but who betray the ignorance of a tyro in an important branch of medicine, will find it necessary to comprehend the relation of electricity to the nervous system.

No class of patients exists who stand in more need of the decided advantages of proper electrification than the very ones

who are often prevented by wrong advice from seeking its aid.

It is often noticeable that consultants of the greatest prominence in handling these cases are unable to suggest any medication with much confidence, and adopt the habit of referring the invalid to "time and rest." Great injustice is done the patient in hundreds of cases by such advice, and as the study of electro-physiology is open to every inquiring physician, even though he may not possess any electrical apparatus of his own, there is no excuse for failing to give the invalid's shattered nervous system the benefit of every sedative tonic and restorative agency available in practical medicine. Among such agencies static electricity stands in the front rank.

Acute Neurasthenic Insomnia.—Every now and again some case of complete nervous bankruptcy comes prominently before the public by reason of the distinguished character of the victim.

The class of cases to which I refer will be understood by all who recall the sad end of one of the great trio of New York journalists of a generation ago. For a little more than a quarter of a century he ruled supreme in the affairs of the great newspaper he created; then suddenly the next act in the drama took place in an insane hospital. The stricken heart and overburdened mind had given way, sleep was denied the man exhausted by the labors of a fruitless campaign and by acute grief for one over whose last hours he had kept ceaseless vigil day and night for more than a week. After this came the great blow of a trusted friend's supposed perfidy, and nature yielded to the strain. His tragic death speedily followed. Could sleep have been procured he might have lived another score of years.

The greatest experimental electrician the world has ever seen broke down in the midst of his immortal and unrestrained labors in 1840. Scott did the same thing when he was giving to the world the last of the most original, prolific, and successful series of novels that ever emanated from a single brain.

The history of our own feverish age of professional, political, and commercial activities is filled with examples of mental wreckage—too often followed by the climax of uncontrollable insomnia, lingering misery, or death.

A striking case in point comes before me as this chapter undergoes preparation for the press. The account made public should fix a lesson upon the mind of every practical therapeutist, and for this purpose it is repeated here:

General ——, who has been prostrated for the past few days with a severe attack of neurasthenia, was no better this morning. The General complains for the past fortnight that he has had hardly any sleep, except what has been induced by occasional doses of morphine, which, however, his physician would not allow him to have often. "I spend the greater part of the night," said the General, "in walking up and down the floor here. I feel utterly worn out, and fear the worst consequences of my illness. The most distressing symptom is this horrible restlessness and insomnia. I also suffer from severe pains in the forehead, and I find that I cannot keep my attention fixed on a book or anything else for any length of time. I cannot describe the utter despondency I feel. My doctor advises me not to lie in bed all day, but go out for drives occasionally, which I sometimes force myself to do. He often advises me not to make myself miserable about my condition, but that is easily said."

The condition described is a trumpet call for static electricity.

It is my belief that the physician who withholds from such a patient in his extremity the best resource that medical science contains fails in his duty. If the physiological and therapeutic properties of action claimed for electrical currents when rightly administered are demonstrably true—as the writer believes and knows they are—physicians who continue to disregard or ignore clinical facts of such vital importance assume a moral responsibility for which there is no excuse or warrant, for ignorance is no excuse either in the eyes of the law or in medicine.

It is well known that it is within the power of electro-sedative-tonic applications in restless states to tranquillize the

central nervous system, equalize the circulation, and restore the restfulness that is temporarily lost to the control of the will. In acute cerebral exhaustion there is little will-power left to coerce the hyperexcitability into calm and sleep. "As well," said Sir Walter Scott to his doctor, "put a kettle of water on a red-hot stove and tell it not to boil as tell me to stop thinking."

Advice does these patients little good, nor are hypnotics and drug sedatives alone to be relied on. Both physical and mental nutrition must be restored, and cardiac depressants are not infrequently dangerous. The most urgent indication in nearly every such case is electro-tonic sedation. Every other resource of medical skill may indeed be employed, but electricity in suitable form is wellnigh indispensable.

It would be impracticable to attempt to set down rules for the treatment of this desperate insomnia, for no physician could in such a crisis depend upon book study. He must understand technique in advance, or he must turn over the case to some one already experienced in electro-therapeutics who can select and modify as needed the galvanic, high-tension induction coil, or static applications. A simple suggestion which may be safely inserted here would be to seat the patient on a static platform insulated negatively and apply a strong positive head breeze, spinal breeze, and tonic spray to the region of the medulla for a sufficient time to produce a marked impression upon the great nerve centres. This would require perhaps ten minutes. Then in a reclining-chair with simple positive electrification leave the sufferer in the quiet of a somewhat darkened room with a watchful but silent attendant.

If the plates are revolved by an electric motor an hour may go by in the undisturbed repose and probable sleep of this exceedingly restful and restorative administration. It can certainly do no harm; it can be repeated once, twice, or even three times a day until the crisis is passed; it can be modified by the expert to meet every emergency of the patient's functional condition; it can be supplemented by local applications and by

any and all other remedial measures, and it will conflict with none. It is certainly a duty to point out to physicians the immense value of this agent (static electricity) when exhausted nature demands sleep as the condition on which health depends. Those who ignore the facts of electrical sedation do so against the best interests of their patients. Potential alternation would also be an admirable method.

Chronic Insomnias.—Various forms of electricity indirectly improve sleep by relieving symptoms upon which wakefulness has depended, and by regulating functions and promoting nutrition in general.

It is one of the common observations of clinical experience that improved sleep is one of the first signs of benefit even when the application is local and to parts distant from the head. This is true of all currents and of the most diverse variety of methods of technique and dosage. No electrical application is a direct and forcible sleep-compeller, but no narcotic or active hypnotic equals in kind and degree the effects of electrical treatment upon the insomnias which it can indirectly overcome.

In ordinary cases the symptom of insomnia existing in a mild degree takes care of itself in the general process of improvement without any direct attention. In other and more severe cases attempts to treat this symptom directly by an electric current may be made with:

1. Negative static electrification with positive breeze and spray impressions upon the cranial and spinal centres, or simple positive electrification, or the author's method of potential alternation.

2. The electro-thermal cabinet bath with a combined galvanic and faradic current from the cilio-spinal centre to the feet.

3. Central galvanization.

4. General faradization with either induction coil or Leyden-jar currents.

If the continuous static application is selected the patient should repose comfortably in a reclining-chair upon the static

platform holding loosely in one hand the rod or chain connected with the negative pole. Ground the positive pole and the brass point electrode.

With the machine in moderate motion sweep the point of the electrode sufficiently near the spine to produce an agreeable breeze up and down its entire length. In a moment advance the electrode closer and make a decided spray impression upon the region of the cerebellum and medulla.

After about five minutes repeat the same impression upon the lumbar spine, and then either adjust the head-breeze electrode at a comfortable distance and continue the administration in this manner for about ten minutes, or, if thick hair, metallic hairpins, or other conditions prevent an agreeable effect upon the head, change the platform rod to the positive pole and give simple positive general electrification.

The method of applying the vibratory electrification with an oscillating potential is described elsewhere. It is exceedingly restful as well as energizing, and under its influence I have seen the patient who had been unable to obtain satisfactory and restful sleep for two weeks, declare that she felt very drowsy and was ready for a nap ten minutes after she stepped upon the platform. This method comes the nearest to producing direct hypnotic effects in insomnia of any known to me.

It is well in these cases to request patients to sit with closed eyes and compose themselves in the most quiet manner. The judgment of the physician should observe and attend to any existing conditions which prevent sleep and call for special treatment either medical, surgical, electrical, or hygienic. Digestion and nutrition very often demand attention. In many cases other resources of static electricity may be added to general electrification, but the indications for their use will be found in local conditions accompanying the insomnia, and each patient must be treated in accordance with the state presented.

Sittings should be repeated daily at first, and in private practice a sedative may be advisable at bedtime when needed until

general improvement obviates the necessity. This will refer mostly to complications of pain. Electricity is not usually a direct hypnotic, and while it is curative of the conditions on which some forms of insomnia depend, it is indirect and requires time. In suitable cases its benefits are more appreciable, lasting and satisfactory than almost any other method of treatment.

It is obvious however that lack of sleep may be due to causes which lie entirely without its sphere of action, and the compulsory sleep produced by a narcotic is called for in a class of cases radically different from those which are suited to static electrification. Probably electricity is entitled to rank first as a curative agent in ordinary curable cases of insomnia.

CHAPTER XLIII.

TREATMENT OF NEURALGIAS AND NEURITIS.

Resources of electricity. Facial neuralgia. Supra-orbital neuralgia. Neuralgia from lead hair tonic. Neuralgias in general. Methods of static treatment in different parts of the body. Præcordial pains. Neuralgia of the heart. Treatment of sciatica. Faradic method. Galvanic method. Static methods in full. Clinical observations upon sciatica. Traumatic neuritis and recent or chronic effects of cold and damp. Neuritis, recent stage. Faradic sedation; chronic stage. Weather neuroses and their treatment.

"So nearly certain is electricity in some form to relieve an idiopathic neuralgia that if proper electro-therapy fails, time will usually show a severe pathological condition to exist in the vicinity of the nerves—as, for instance, neoplasms, an abscess, or some severe general bodily ailment as diabetes." (*Benedikt.*)

The commonly recommended blisters, cups, cautery, rest cure and all the analgesics of the materia medica cease to interest greatly the physician who is able to command the resources of electrical currents, although at times in the beginning of a very severe case some temporary aid to sleep may be advisable. If also any case of neuralgia presents clear indications for curative drugs they will be given the practical preference by most physicians and patients. The neuralgias that come to the electro-therapeutist are mainly of an inveterate character and have already resisted drug action.

Static electricity contains more than one valuable resource with which to combat, and at least palliate, and often in time effectually cure, this frequent and distracting form of pain. Positive electrification is a general nutrition improver; the positive breeze is a local sedative; the negative breeze and spray are stimulating, and the friction spark is counter-irritant; the

long thick spark is a powerful agent for good within muscular tissues, while the rapidly interrupted Leyden-jar current of high potential and high frequency is sedative and corrective in stil another way.

Facial Neuralgia.—*Galvanic and Faradic.*—Moisten a felt-covered, flat electrode, about 3×4, connect it with the negative pole of the high-tension induction coil apparatus and

Fig. 352. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

apply it to the back of the neck. Select a small sponge-covered hand electrode about two inches in diameter, moisten it in

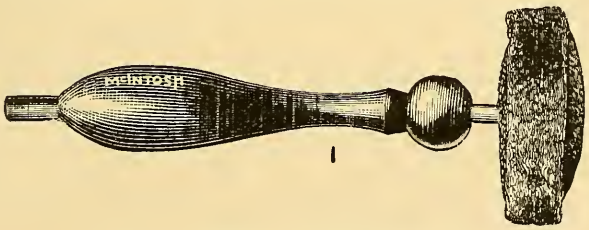


Fig. 353. Sponge-covered hand electrode.

hot water, connect it with the positive pole and press it steadily upon the painful point. Do not move while the current passes.

Switch the full compound coil of nearly 8,000 feet into circuit with the rapid vibrator and three or four cells. Gradually increase the current strength through the secondary rheostat from zero until it grasps the tissues with a comforting, powerful and

painless pressure upon the aching nerve. If the proper dosage for any given case requires a modification of the coil the switch arm of the author's apparatus may easily be moved from one button to another until the correct current strength is adjusted. The secondary rheostat which controls all degrees of current effectually obviates any shock to the patient while regulating the dose. This is an invaluable feature of the apparatus.

Pour into the tissues the strong and steady current until it annuls the pain and accomplishes complete sedation. After the pain has entirely ceased, maintain the current for two or three minutes longer and then very slowly and very evenly raise the movable rod in the rheostat to reduce the current to zero by imperceptible stages.

Repeat daily at first or as often as is needed for relief.

If relief progresses favorably under the action of this current continue its use. If it has no favorable effect it should be discarded and the galvanic current substituted in the same manner. These methods apply to the treatment of any facial neuralgia regardless of the particular nerve filament affected. In a chronic case associated with anæmia substitute the negative for the positive pole of the galvanic current over the painful point.

In all cases, however, the first choice of treatment by all who possess the static apparatus will be the static spray.

Supra-orbital Neuralgia.—The first electrical procedure to try is the positive static spray, rather than the galvanic or high-tension induction coil currents, because it is not only the most simple and often very effective application, but it involves also the constitutional benefit of general as well as local treatment.

Seat the patient upon the negatively insulated platform. Ground the positive pole and brass point electrode to the gas fixture. With the machine in moderate action apply a concentrated positive spray upon the site of pain until it is removed.

The point of the electrode should be held within a short distance from the surface—just beyond sparking distance—and kept in gentle motion over the affected area. The use of the

hand electrode in these cases is preferable to a fixed electrode upon a standard, as it can be instantly and always under the control of the operator, regarless of any movement of the patient's head.

The delightful nature of this application will sometimes induce the patient to bend the head nearer the electrode, and use of a standard with the liability of a spark which is not wanted is imprudent.

Add to the local application a general nutritional *séance* of five minutes. To apply a static spray to the face or any part of the head without sometimes startling the patient by a vagrant spark will be found to require some manual dexterity and careful attention to the treatment.

If the general condition of the patient is such that positive electrification instead of negative is especially desired, the breeze must be applied in another way.

Connect the platform with the positive pole. Ground the negative pole to the water pipe. Do not employ the brass point, but fix a fine wire spray electrode upon the standard so that it will present its multiple needle points in front of the supra-orbital nerve, at a distance of two or three inches—the exact distance depending upon the rapidity of the machine and the vigor of the current.

Ground the standard to the gas fixture, instruct the patient to maintain the average distance from the electrode, but to turn the head gently from side to side so that the breeze will play like a refreshing zephyr across the forehead and upon the temples.

Start the machine into action very slowly, and cautiously increase the current until it is as strong as it can be made without risking a spark. The chin must be tilted up so that the breeze does not irritate through the hair. Its sedative effects depend upon its application to an uncovered skin. If the electrode is removed farther away—ten to twenty inches—it not only becomes diffused when it should be concentrated, but loses its soothing character and is exceedingly irritating.

The secret of many good effects of the static breeze depends upon concentration of action, and when it is diffused, either by the size of the electrode or the distance at which it is manipulated, the sedative effect is lost.

Apply either form of breeze until the pain is entirely relieved, and for several minutes thereafter.

These two methods, one with negative and one with positive electrification, may be employed, and experience rather than printed directions will suggest the choice between them. If they do not afford a relief which gradually endures for a longer interval after each *séance*, with promise of becoming permanent, the case is not suited to this form of current. The static spray, however, in experienced hands will fail less frequently than many other much-praised remedies, and we still have left the galvanic and coil currents and cataphoric medication among the untried resources of medical electricity.

Facial Neuralgia from Use of Hair Tonic Containing Lead.—Seat the patient upon the static platform connected with the negative pole, ground the positive pole and brass point electrode to the gas fixture, start the machine into moderately rapid action, and hold the point persistently within a short distance from the seat of pain for from five to eight minutes, or not less than two minutes after all pain has ceased.

The spray should be so concentrated as to present the visible bluish discharge, but not contain any sparks at first, although as soon as the patient is accustomed to treatment I always let a few mild sparks pass to the muscles from the point of the electrode in addition to the spray. Repeat this treatment daily until relief lasts longer, and then as needed till entire recovery.

While at the beginning the hair tonic will of course be stopped, and potassium iodide administered internally to eliminate the lead, yet the static spray will not wait for the action of this remedy but will at once afford the patient a character of relief that is unspeakably grateful. I have even relieved such a case without any iodide at all.

Neuralgias in General.—For neuralgias in general, affecting the face, head, hands, feet, or any bony part to which sparks cannot be readily applied because of lack of muscle covering, the first choice of method is the positive spray, with the patient insulated negatively, and the positive pole and the brass point electrode grounded.

In concentrating a decided spray upon the seat of pain I always keep the electrode in gentle motion and near enough to establish a visible brush discharge, which is my guide to the strength of the dose. For this reason I generally have the patient sit so that the part undergoing treatment is in the shadow.

When the static machine is operated with a motor the plates will almost instantly increase their speed, as the electrode attracts from the patient the accumulated charge, breaks down the insulation and lessens the resistance against which the machine works. For this reason the electrode must be managed with skill to regulate the proper strength of the application, and if the plates become too rapid the street current should be cut down to lessen their speed.

It is an important point to persist until pain is gone. In favorable cases this will occur in a very few moments, sometimes in a single minute, but I generally continue the spray for about double the time which elapsed before the pain ceased, or a total of from six to ten minutes.

Close the *séance* by devoting five minutes to general nutrition treatment adapted to the state of the patient.

Sittings should be repeated with reference to the severity and frequency of the paroxysms. My usual plan is to secure daily sittings if possible for at least the first week, and then adjust frequency to the needs of the case as they develop.

By the joint aid of static and galvanic currents the great majority of neuralgic pains can be satisfactorily relieved regardless of a differential diagnosis as to the cause, and with permanent results if the cause is also one which is amenable to their action.

In neuralgias affecting nerves below the neck, in regions covered with muscle, the static spark is probably more effective than any other treatment. It is not always so with pain in regions of bone and ligaments, for it is then disagreeable and less suited to the case. Deep visceral neuralgias also do much better with other currents than with ordinary static, although sometimes they do very well with sparks.

The great sphere of static electricity in the form of sparks is in parts covered with abundant muscle substance, in which contractions develop and increase the actions set up by their nutritional blows.

The anodyne effect of a single static treatment of a severe and chronic neuralgia will necessarily be short, as would also be the best effect of any single dose of medicine. Therefore sittings should in obstinate cases be made as often as pain demands, unless some palliative that is not harmful can be satisfactorily employed between sittings which are farther apart.

In a great many cases circumstances and the financial or domestic affairs of the patient decide such matters rather than the exact therapeutic indications. Effectual cure, however, must be looked for in chronic cases along the lines of gradual nutritional improvement rather than from local and simply pain-relieving applications. Therefore every static sitting should aim at constitutional benefit, and the relief of any present pain is to be regarded as only a part of the patient's needs.

Præcordial Pains. Neuralgia of the Heart.—By the above terms I refer to patients who complain of pain in the region of the heart, which may be sometimes very persistent and very distressing, but which is obviously not true angina pectoris. I have never treated or attempted to treat any case of the latter disease with electricity.

The other cases are relieved by both galvanic and static methods.

Galvanic.—Moisten a felt or sponge covered, flat electrode, about 4×6, in the hot-water solution of bicarbonate of soda,

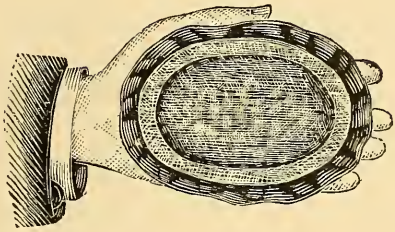


Fig. 354. Sponge-covered flat electrode.

connect it with the negative pole of the galvanic battery and apply it to the back of the neck. Moisten a smaller hand electrode, connect it with the positive pole and apply it over the

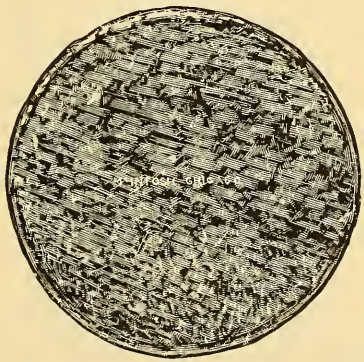


Fig. 355. Felt or sponge covered flat electrode, assorted sizes.

site of pain. Gradually increase the constant galvanic current through the rheostat up to 5, 10, and very slowly on up to 12 or 15 mil., if tolerance permits after the first sitting. Maintain the current at a comfortable dosage until the pain is entirely gone and for three minutes thereafter. Very gradually reduce it to zero and remove the electrode. Dust the skin with toilet powder and repeat daily until relieved. Continue treatment three times a week until no relapse occurs.

This purely local method often requires to be supplemented by medical treatment and sometimes by the general nutritional properties of static electricity.

Static.—Seat the patient upon the static platform connected with the positive pole. Ground the negative pole and the multiple point electrode. If the patient has on silk or woollen garments to produce a counter-irritant effect start the machine into moderate action and move the electrode over the surface sufficiently near to produce a mild comfortable anodyne effect, secondary to counter-irritation. If the clothing is not adapted to this purpose have the patient spread over the chest a piece of cloth kept at hand for this purpose. About five minutes is required to allay the pain in all cases to which this application is suited, and the remainder of the sitting can be employed for general tonic effects which are usually needed.

Sciatica.—During the past fifty years sciatic neuritis and neuralgia have been treated in all stages and in all degrees of severity by a variety of electric methods which have been needlessly complicated in electro-therapeutic literature. These methods include the use of galvanic currents with needle puncture and with rectal and external electrodes in almost all doses ranging from one mil. to one hundred mil. Faradic currents have been employed with needle puncture and with a variety of surface methods. Static electricity has been referred to by an occasional writer.

The average physician may rise from prolonged study of the works of a score, or even a hundred, authors who are considered neurologists of distinction without knowing how they actually treat patients in their own office who are affected with different degrees of sciatica. I discover no reason for complicated methods of treating sciatica with electric currents. As the outcome of my own clinical experience I do not now usually treat cases of sciatica with galvanic or faradic currents, for they are not only more troublesome to employ but do not always equal the clinical results of static electricity. In the successful treatment of sciatica, static electricity does not require the aid of any other electric current or any other external application, but needs only to be supplemented by judicious prescribing for such cachexias as may accompany the disease.

In these cases the physician should be on the watch to detect indications for special drugs and prescribe them accordingly.

Methods described for the treatment of sciatica by the aid of galvanic and faradic currents are too various to quote them all. The following are practical.

Faradic.—Select a felt or sponge covered, flat electrode, about 4 × 6, moisten it in hot water, connect it with the nega-

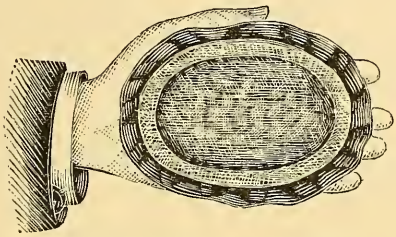


Fig. 356. Sponge-covered electrode.

tive pole of the improved high-tension induction coil apparatus and place it under the sacrum with the patient recumbent.

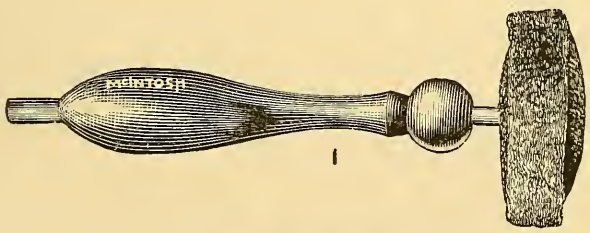


Fig. 357. Sponge-covered hand electrode.

Moisten an ordinary sponge-covered hand electrode in hot water, lubricate it with a little soap, connect it with the positive pole and place it in contact upon the course of the nerve. Switch the 1,000 yard No. 36 wire coil, the rapid vibrator and three or four cells into circuit. Increase the current strength through the secondary rheostat from zero until a strong sedative current is obtained. If the tissues are in a less acute state and are not sufficiently affected by the No. 36

coil change the switch arm to the 800 yards No. 32 coil and regulate the dose with this. Hold the electrode steadily upon local sites of pain until the pain disappears. When the pain is controlled, promenade the electrode over the course of the nerve and adjacent muscles for nutritional effects.

Repeat daily until improved, then every second day, and as relief increases repeat p. r. n. until benefit ceases.

While I have never become aware of any cases in which it could be claimed that faradic currents gave results superior to static electricity, yet I have often successfully finished the treatment of patients who had been previously treated with "faradization." In a recent case of this kind, a man thirty years of age had received twenty-one faradic applications from a physician who is known throughout the country as a gynecological surgeon. The patient received at first the usual tonic benefit generally imparted to the tissues by a faradic current, but his sciatica did not get well. After waiting some time and finding further need for treatment he was completely relieved by seven static applications. After the fifth he had no return of pain.

Galvanic.—Moisten a felt-covered, flat electrode, about 6 × 9, in a 2 per cent. solution of bicarbonate of soda, connected with the negative pole of the galvanic battery, and place it under the sacrum with the patient recumbent.

Connect a similarly prepared electrode, about 4 × 6, with the positive pole and maintain it in firm contact over the most painful point in the course of the nerves. Gradually increase the constant galvanic current through the rheostat from zero until a comforting warming sensation of relief is gradually produced. Maintain the application for five or ten minutes and reduce the current to zero. Transfer the positive electrode to any other painful point and repeat the same application. If the positive electrode, which is generally indicated in the most acute stages, does not give satisfactory relief test the effect of different degrees of current strength, and if this proves unavailing reduce the current to zero and change the polarity

so that the negative is over the painful point. In almost all chronic conditions the negative current is indicated.

In the average application the current strength will be 5 to 15 or 20 mil. In some cases the practised operator will run this up to 40 or even 60 mil., while in other cases the need of a milder current will be plainly seen. In almost all conditions amenable to treatment by electric currents the condition of the individual patient furnishes a clear guide to the regulation of the dose, and specific directions cannot be laid down in advance, for the name of a disease, whether it is sciatica, chorea, rheumatism, or any other name, gives no clue to dosage until the patient is seen.

Some physicians especially recommend the employment of very small galvanic currents of half a mil. for about one minute. It seems, however, needless to discuss minutely all of the various methods of treating sciatica, for two or three selected methods are sufficient for practical purposes. It is obvious to the reader that if the clinical results of a method of treatment which can be employed without any removal of clothing and in a few moments' time are equal to the results of treatment by other methods which require exposing the surface for the direct contact of electrodes the easier method is the best method. For this reason I prefer static electricity in my own practice, and as I consider the results superior to those obtained by any other method my satisfaction in its employent is also enhanced on this account. Blisters, punctures, liniments, lotions, hypodermic injections and most of the methods recommended for the treatment of sciatica become obsolete to the physician who employs almost any form of electricity in a competent manner.

The following remarks, taken from a prominent journal, are quoted here to caution physicians against adopting any such methods. In the round of changes that have been rung in the methods of using galvanic and faradic currents for the cure of sciatica, from needle puncture to high intensities, the practi-

tioner who is without experience may well feel perplexed to know how to best proceed.

The novice who employs electric currents by some of the recommended methods will lose his patients or dissatisfy himself as a rule.

Sciatica is well known to be one of the most obstinate of maladies. One of the newest and at the same time most successful methods is that by Dr. Dubois. It is based upon the employment of high intensities applied along the nerve.

He is the first to treat this disease systematically by means of these high intensities (100 to 120 ma.), and Dr. Damon has confirmed his results, and has obtained cures by this means, in cases that have resisted every other kind of treatment, electric or otherwise. Another new method is one that has been thought out by Dr. Damon, in cases where the disease attacks females. Dr. Damon was first led to this method by observing the remarkable results obtained when treating, for fibroid tumor of the womb, women who were also suffering from sciatica. It is easy to understand why this should be, for there are many branches of the plexus or of the nerve roots that may be affected either individually or along with the main trunk. It is almost impossible to reach these branches by means of external applications of electricity, while on the other hand access is readily gained to them by means of the vagina in women or through the rectum in men, after injecting a certain quantity of water. These two methods which we have just mentioned deserve not only to be spoken of, but to be placed at the head of the various methods for treating this affection. (*Teste.*)

The static methods are as follows:

Static.—Insulate the patient with the platform rod attached to the negative pole of the static machine. Ground the positive pole and electrode to the gas fixture.

If the case is acute, with considerable tenderness to pressure, use first the brass point electrode moved agreeably over the painful parts with two or three inches of spray gap. Keep the machine in moderate action. Gently soothe the entire limb and lumbo-sacral region in this manner for about ten minutes, and apply only a few mild and cautious sparks at the close of the first sitting.

If the case is subacute or chronic, a thorough course of percussive sparks judiciously regulated in strength according to the varying tolerance of the tissues between the ankle and the spine will be effective if properly given.

Begin with very mild sparks and posture the limb variously in every position and degree of muscular tension that can be discovered to aggravate the pain.

In every posture spark the painful point until the pain surrenders, and persist at each *séance* until relief is complete, and the patient steps actively about the room without any pain whatever.

If this degree of relief is obtainable and lasts for a longer and longer time after repeated sittings, the prognosis is favorable for one of the satisfactory cures which do so much to gratify suffering patients.

If absolute relief is not obtainable, either the skill of the physician is at fault or the case is less suited to static electricity. Rheumatism of the hip-joint must not be confounded with a sciatic neuritis or neuralgia in estimating the prognosis, nor, if the patient is a woman, should static sparks be expected to cure a case which should be referred to gynecological methods. My remarks here refer to ordinary sciatica of the form that it is usually expected medical measures will relieve.

Having obtained satisfactory relief from the first application of local sparks, apply sparks to the entire spine and other limb to promote nutrition and advance the improvement.

Repeat sittings daily until pain is absent for more than one day ; then repeat every second day, and if the case is chronic continue treatment two or three times a week till improvement ceases. In all cases, either acute or old, several treatments should be administered after all symptoms have disappeared.

Medication for anæmia, malaria, syphilis, or any other associated state of disease which can be improved by appropriate remedies, is always in order, but drugs directed especially to the sciatica will not be needed.

In the early stage of the treatment of a severe case, even if

the patient is treated once a day, the relief from pain cannot be expected to last twenty-four hours after the sitting, and in private practice a temporary aid to comfort and sleep may be prescribed when the state of the patient demands it. To conquer the sciatica, however, I depend solely upon the static administrations.

From a comparison of my experience with the reports of some other physicians who state that they have been disappointed with the results of static sparks in sciatica, I am inclined to place a high value upon the postures I employ. I have repeatedly taken the electrode from the hands of another operator after the total failure of routine sparks to control the pain, and have relieved the patient satisfactorily in a few moments. Skilful posturing during the application of properly regulated sparks is one of the chief secrets of quick results in all muscular pains which are made worse by movement.

If the case is not sciatica, but is an arthritis of the hip-joint, the spark is at a great disadvantage for reasons fully explained elsewhere, and although considerable improvement can be effected in hip-joint rheumatism by static electricity, the decisive results obtained in a neuritis or neuralgia of the sciatic nerve are not to be expected.

Almost every physician, however, who has a Holtz machine cures his cases of ordinary sciatica with static applications.

A recent contributor to a medical journal remarks that "sciatica is a dire affliction which seems to tax the ingenuity of the average prescriber to such an extent that in the depth of his perplexity he calls for the observations and methods of others to aid him." An authority upon materia medica thus comes to his written aid: "Internally arsenic, iodide of potassium, aconite, cimicifuga and turpentine offer the best means of relief in the treatment of sciatica. Externally massage, acupuncture, chloride-of-methyl spray, extension, actual cautery, blisters and the application of precipitated sulphur to the whole limb sprinkled over flannel and covered with oiled silk. Injections of morphine, atropine and sulphuric ether afford

but temporary relief, and sometimes even aggravate the pain."

This list omits one very important remedy for sciatica, viz., static electricity. The administration of an anodyne is a very different matter from effecting a radical cure. The list of medicinal remedies for sciatica is long, and by consulting various authors it may be increased indefinitely. But the prominence everywhere given in practice to hypodermic injections of morphine, or to the administration of some analgesic, is proof alone that there is no curative drug approaching electricity in value.

Cases have come before the writer with long histories of every possible form of treatment, some of them involving intense suffering in addition to the disease. They have come with scars on their bodies and profound discouragement in their minds (and occasionally resentment for the useless torture to which they have been subjected), and they have promptly began to get well under static sparks.

To effect a cure we must undoubtedly act upon the nutrition of the central trophic cells and the substance within the sheath of the nerve itself, for some degree of structural change in some part of the nerve cell or its prolongation is probably present in all the manifestations of pain which we ordinarily speak of sciatica. Prominent authors contend that it is useless to speak of sciatica without an associated neuritis, which may be acute, subacute or chronic. While the static spark may be theoretically contra-indicated in some cases of sciatica, it is most usefully applied in practice by expert static electricians without regard to orthodox or popular theories.

The painful point and entire nerve course are subjected to a powerful static spark and they cease to ache, and the relief of pain for a brief time after the first treatment will gradually lengthen under repeated treatments until the relief is permanent.

No other plan of treatment known to the author will produce equally swift and certain results; and the cases of this

affection which static electricity fails to cure, if it is administered by competent hands, will be found to be some other disease or pain dependent upon some cause, either incurable or removable by surgery alone. It is stated by a practitioner who has many followers that in cases of sciatic neuritis "rest" is a most important agent. The so-called "rest cure" has therefore been in certain quarters a fashionable fad. After "eliminating rheumatism, gout, syphilis, injury and pelvic growths, and deciding that the case is one of neuritis only," it is considered that—

The most certain indication is to secure rest, not simply by keeping the patient in bed, but by means of a long splint. An old-fashioned long splint from the axilla to the foot may be used, or a roughly moulded anterior splint with a wooden attachment carried up laterally to the waist or axilla.

The ankle must be sustained so that the heel does not carry the weight of the leg; the knee must be gently flexed and the angle of flexion changed a very little at each dressing.

After a few days of undisturbed rest all the joints must be carefully and slowly flexed and extended to a slight extent, to prevent too great stiffness, the common evil which follows the use of the splint. Only sufficient bandage to keep the splint in position should be used. If the patient cannot bear a long splint, an interior suspension splint may be of some service.

By this simple [?] treatment "many cases of chronic sciatica may be overcome which have defied more elaborate treatments."

If the case be not cured by these means, the daily use of Paquelin's cautery button at the painful points is recommended. If still obstinate, employ dry *cold*. A rubber ice-bag is kept on the painful nerve day and night for two or three weeks, or the leg is placed in a tin or copper gutter on the under part of which is an ice case three to four inches wide.

As the pain diminishes, the use of cold is lessened until it is only applied at night or for an hour or two twice a day. If any pain points remain, the use of the cautery is often valuable, but is apt to interfere with massage treatment which is so helpful at this time.

Kneading of the muscular masses of the leg, and also a gradually deeper surface rubbing in a downward direction over the nerve trunk for half an hour twice a day, is now employed.

When the pain has disappeared, it is wiser for a while that

at first the patient should stand aided by crutches and then walk with them, and not sit up long, as this brings pressure on a nerve which may still be sensitive.

Often the patients are thin and anæmic, and general massage is of service after the "rest" treatment has been employed for some time; but at first it must be avoided in order that the resting limb may not be disturbed.

Strong galvanic currents may be of service in the milder forms of sciatic neuritis, but this treatment is as painful and less efficient than the cautery.

If the wasted limbs do not gain in size and tone at the close of treatment, the stimulation of the induction current may aid in producing a more rapid result.

The treatment of chronic sciatica by splint, rest and dry cold as above described is more apt than any other means to effect permanent cure, and it has many times triumphed when all else had failed.

The "simplicity" of this elaborate plan of treatment could scarcely commend itself to the physician accustomed to seating patients upon his static platform, applying sparks for five or ten minutes, three or more times a week, meanwhile allowing them to attend to their ordinary affairs and curing them usually in from ten to twenty treatments.

Neither could it be considered especially simple by the victim of sciatica who had to choose between its somewhat tedious if not exceedingly tiresome procedures, and the alternative of static sparks.

The method has been referred to here at an unusual length because the disease itself is of frequent occurrence and of sufficient importance to receive our fullest consideration; and because the method outlined affords a most remarkable contrast in every way to the treatment by static electricity.

The author of the rest treatment states that he has never met with a case of sciatica in which he was obliged to resort to "nerve-stretching," and points out the fact that nerve-stretching is liable to fail, like all other means. In this last statement I fully concur, but cannot agree with the same writer on another point. In his allusion to "all other means" (except his own method) he omits static electricity, and for this agent

the following advantages may be conservatively claimed and clinically demonstrated.

1st. It is applicable in practically all non-operative cases, and we are not obliged to "eliminate rheumatism, gout, syphilis, trauma, etc., and decide that the cause is solely neuritis."

The number of cases in which static will totally fail is very small. In most cases it will produce at least some immediate benefit. In the majority of cases it will produce curative results if fairly tested, and in recent cases often acts like magic. It would require considerable proof to convince me that any single agent surpasses it in the treatment of sciatica.

2d. The patient is not inconvenienced by forcible detention in bed.

3d. The application of splints, dry cold, bandaging, flexion, extension, kneading, dressing the limb, etc., which evidently require a skilled attendant and a great deal of time, not to speak of the tax upon the patient, are entirely done away with in static treatment.

4th. Long and enforced rest impairs the muscles in tone and function; sparks give firmness, activity and strength to the entire limb thus treated. No muscles can waste away under static sparks.

5th. Relief is manifestly more prompt. In fact the patient steps from the platform free from all pain at the end of the first and each succeeding treatment, and this relief in time is usually permanent.

6th. If a cure is effected it is done in much less time.

7th. If static fails, its failure will be quickly demonstrated so that little valuable time is lost and other measures may be tried, while all medicinal indications may be fulfilled from the very commencement.

8th. If the patients are "thin, anæmic, rheumatic, paralytic," etc., the static treatment is directly beneficial to these existing conditions. Scarcely any better could be devised.

9th. No "painful cautery buttons" or other "painful" auxiliary aids are required,

10th. When the pain has disappeared the patient is not weakened and wasted by long inaction so as to require "massage, faradism and tonics to build him up, and crutches to assist in standing and walking," but under static sparks he has been gaining strength and muscular activity and endurance, hand-in-hand with the disappearance of the pain.

To the author of this work these seem advantages that would have peculiar weight with the patient as well as with the general practitioner, although it is readily surmised that with the resources of a sanatorium to administer the details of the rest cure, the longer method would possess an undoubted financial attractive

Traumatic Neuritis, and Recent or Chronic Effects of Cold and Damp.—Seat the patient upon the static platform, insulated negatively. Test the tolerance of the part affected with a gentle local application of the mild positive spark. If the spark is not tolerated in an acute condition, a positive spray may be applied for the relief of pain until improvement permits a spark. Cases, however, rarely come to the office in a state into which some intensity of spark cannot be applied by at least the second treatment, with positive and progressive benefit thereafter.

In all chronic cases the spark is certainly *facile princeps*. Use it with judgment and care equally to avoid "too little" and "too much," and no other form of treatment will be required for ordinary cases. Repeat as often as needed for relief of pain and acute symptoms, and continue later treatment three times a week.

Some of the most interesting effects of static electricity are observed in the treatment of neuritis and associated pains. When a so-called neuralgia is caused by an inflammatory exudation somewhere in the nerve sheath—an exudation which must be absorbed to obtain relief—then static sparks are certainly the sovereign remedy. Not only are galvanic and faradic currents more troublesome to apply, as they require the removal of clothing, but their curative effects in these cases

are decidedly inferior to the powerful, deep-acting, anti-congestive, anodyne and nutritional spark.

If inflammation has proceeded to destruction of nerve tissue, with wasting and degeneration of muscles, the treatment should be supplemented by the use of a slowly interrupted Leyden-jar current in the same manner that the faradic current is employed in other atrophic and paralytic states.

Neuritis.—*Recent stage.*—In the acute stage, without plastic exudation, the indication is to relieve the swelling and congestion of the nerve trunk and cut short the inflammation. Pretty nearly the whole gamut of possible galvanic methods has been run, and the common faradic battery has taught practitioners to avoid it. It is generally advised to wait till the case is chronic, and then to place the positive electrode at the peripheral end of the lesion and the negative at the central end, employ a mild constant galvanic current for not over five minutes and repeat daily for from two to four weeks. One prominent neurologist advises the early use of currents as small as one-half to one mil. for one or two minutes only. Another writer observes: "The case of neuritis that is cured in less than six months is indeed a mild one. Many cases require steady treatment for one or two years."

Still another very experienced physician states: "I have never seen any benefit result from treating neuritis with galvanism. You can relieve the pain for the time being, but I believe that when it returns (in acute cases) the congestion will be a little increased."

Faradic Sedation.—Moisten a felt or sponge covered, flat

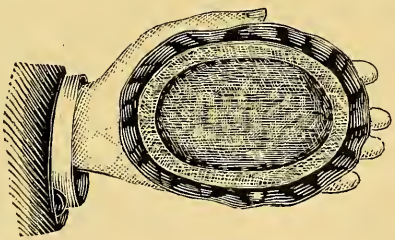


Fig. 358 Sponge-covered flat electrode.

electrode in hot water, connect it with the negative pole of the improved high-tension induction coil apparatus, and apply it upon any neutral convenient situation so that the current will flow through the tissues in the same direction as the blood current. Moisten a similar electrode about three inches in diameter and connect it with the positive pole.

Switch into circuit the 1,500 yard No. 36 coil, the rapid vibra-

Fig. 359. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

tor and four or five cells. Apply the positive electrode upon the most important focus of inflammation and gradually increase the current strength through the rheostat from zero until it produces a sedative and comforting effect. As sedation is accomplished directly beneath the electrode shift it very gradually along the nerve trunk until sufficient relief is afforded. Repeat twice a day if necessary or p. r. n. Use any coil that produces the proper dose and relieves the pain.

Chronic Neuritis.—When the inflammation has entirely subsided and there exists either contracted or atrophied and partly paralyzed muscles the indication is to promote nutrition, reduce abnormal contractions and restore the function of natural contractility. The principle involved is that of the treatment of atrophy and paralysis. Galvanic, faradic and static currents all have their place in different cases.

The constant galvanic current will at first improve nutrition independent of contractions and may begin the treatment.

When contractions are in order an interrupted current must take up the work.

If the atrophy is so far advanced that the muscles require the interrupted *galvanic* current to produce contractions it should be employed. The static spark is admirable to arouse latent nutrition. The slowly interrupted induction coil current or Leyden-jar current is indicated in the treatment of the ordinary paralytic condition. The methods are those employed in the treatment of paralysis. If plastic exudation has taken place and pain remains chronic and relief from treatment is temporary and evanescent it is probable that the nerve filaments are imbedded in plastic deposit which must first be absorbed. In ordinary cases the static spark and the rapidly interrupted induction currents will remove recent effusions, but if no improvement takes place after sufficient time, cut down upon the nerve trunk and loosen it from its adhesions, after which, the electrical treatment will produce its usual satisfactory results.

Weather Neuroses.—There are various well-known diseases of the nervous system whose symptoms, or at least the intensity of whose symptoms, are greatly influenced by the state of the weather. This is true both of diseases which may be demonstrated anatomically and of various neuroses.

Examples of the former are the lancinating pains of locomotor ataxia, chronic myelitis, meningomyelitis, multiple neuritis and various neuralgias. Examples of the latter are hysteria, neurasthenia and epilepsy.

It is also well known that the state of the weather influences the disposition, desire and ability to work of a great many nervous people. In addition to these conditions there are, however, various others whose presence is manifest only during certain states of the weather. At other times the patient usually makes no complaint. The symptoms of these weather neuroses are pain, often of a lancinating character, disordered sensibility and muscular weakness.

The localization, distribution, intensity and duration of

these are subject to great variation, and complications may exist with other nervous conditions, such as neurasthenia, etc.

The development of these neuroses is usually due to anomalies of *nutrition*. The majority of cases of pains in the joints and extremities in old people which are usually considered as chronic muscular rheumatism are regarded by Lowenfeld as more properly to be looked upon as weather neuroses. In health there is a perfect adjustment between the centrifugal pressure of the circulation and the centripetal pressure of the weight of the atmosphere. Changes in the latter, as indicated by the fall in the barometer at the approach of a storm, are readily compensated for in the softer tissues by the freer movements of the nerve fibres when the intravascular pressure is unbalanced but in the denser fibrous tissues of the body the nerve filaments cannot escape from pressure and consequently express themselves in pain. The susceptibility of patients with any form of fibrous-tissue inflammation, rheumatic, gouty, etc., to changes in the weather is due to a similar cause.

Lowenfeld refers at some length to these conditions and summarizes treatment in the brief remark that it should consist of "electricity to the back and over the course of the nerves, with attention to the general nutrition." Equally indefinite are most of the references to electricity in books of general medicine. Without hint as to current, polarity, dosage or manner of treatment, the practising physician is unable to follow such a writer. These symptoms of disordered nutrition, these peripheral neuroses, call for nutritional applications of general static electricity.

Seat the patient upon the platform connected with the positive pole and apply a strong positive charge—preferably potential alternation—for about five minutes. Then stop the machine, connect the platform with the negative pole, ground the positive pole to the water pipe or gas fixture, and also ground the brass point electrode. With the plates in vigorous action apply a positive spray to the spine for three minutes by sweep-

ing the point up and down its entire length, just far enough away to avoid a spark.

Apply the same spray to the forehead, vertex, occipital region or any part of the head which may be subject to pain. Below the neck attack the sites of pain with the grounded brass ball electrode, which should be next substituted for the metal point. Apply sparks to the entire spine, to the muscular parts of both upper and lower extremities, and to the distribution of all nerves manifesting symptoms. The first application should be very mild, and the later dosage adjusted to the patient's needs, according as the improvement progresses or relapses. Devote five or more minutes to this part of the *séance*.

If the patient is elderly or feeble a semi-reclining chair with cane back and cane seat should be employed, so that the full sedative-tonic, nutritional effects of the positive electrification and breeze may be realized with the system at complete rest, and in these cases the use of sparks should be delayed until late in the course of treatment, and unless they are indispensable they should be omitted altogether.

Repeat treatment three times a week in chronic conditions, but in acute exacerbations the sitting should be daily until relief becomes sufficient to extend the time. Those who do not possess a static machine but wish to employ electricity may attempt to combat these conditions by general faradization.

CHAPTER XLIV.

TREATMENT OF MUSCULAR RHEUMATISM.

Treatment of lumbago and all forms of muscular rheumatism and muscle pains. Obstinate chronic lumbago and similar conditions. Static methods. Faradic treatment of muscular rheumatism of the arm and lower extremities. Faradic treatment of lumbago. Clinical remarks comparing galvanic, faradic currents in myalgias. Treatment of wry neck following abscess. Stiffness and soreness of the neck muscles following inflammation of the throat.

Lumbago, Torticollis, Cervicodynia, Pleurodynia, and all Forms of Muscular Rheumatism and Muscle Pains, Acute, Subacute or Chronic.—Seat the patient, fully clothed, upon the insulating platform of the static machine, and connect it with the negative pole.

Ground the positive pole, together with the brass point electrode, to the gas fixture.

Start the machine into moderate action and apply a concentrated positive breeze to the painful part. Gradually sweep the point nearer the surface so that a succession of spray showers will be thrown upon the muscle.

In a moment increase the intensity of the application so that fine needle sparks mingle with the spray. Have the patient attempt such movements and postures as are most difficult to make and which aggravate the pain. The effect of this positive spray will immediately be warming, sedative, relaxing and anodyne to the stiffened and sore muscles. In very recent and simple cases such a counter-irritant spray will produce entire relief in from three to ten minutes.

If the case is of a little longer standing slow down the machine, which has gained quite a rapid rate during the spray administration, and apply a sufficient number of positive sparks from the grounded brass ball electrode to complete the relief.

Begin with a very mild spark and increase the vigor gradually until results are secured. Avoid bony prominences about the joints. Apply single, thick, clean sparks directly to site of pains and over adjacent muscles. Apply a few at a time and note the relief afforded. Continue to posture the patient so that every possible aggravation of the pain is caused, and in each position apply the sparks until relieved.

Persist until the patient steps from the platform free from pain and walks and moves about with perfect comfort. Never let a case of myalgia get off the platform while any pain is left.

If the case is more chronic and deep seated and has resisted a good deal of treatment in other hands, proceed at once to vigorous counter-irritation and strong sparks, with the platform connected to the positive pole and the negative grounded. With the brass point electrode throw repeated showers of hot spray upon the stubborn muscles and finish the attack with strong, sharp sparks.

If the lumbar region or an arm is affected, or any part over which the brass ball electrode can be rapidly rubbed a few times to set up an intense stimulation by friction, do this for a moment at the end.

Time required in any case will rarely exceed ten minutes. Repeat sittings daily at first in acute or severe cases. In others, or after partial relief, repeat every second day or three times a week.

Complete and permanent effects will vary, with the nature of the case, from one to four treatments in mild recent cases to perhaps a month in some that are very chronic.

If static electricity is properly applied to muscular rheumatism and fails to produce satisfactory results, the patient has *some other affection and not* muscular rheumatism. There is nothing more certain in therapeutics than the absolute relief to all forms of muscular rheumatism afforded by electrical currents, and the simplest and most effective current to apply is usually the static.

When we consider other internal and external methods of treatment differently advised in almost every text-book on general medicine, and the uncertain results which many patients obtain from common practice, including hypodermics of morphine, plasters, and liniments, the positive value of static electricity in myalgia cannot be overstated. An eloquent author of "A Practice of Medicine" (1892) devotes a dozen lines of warning against the use of opium in this affection, but his sole reference to the one remedy which is wellnigh an unfailing specific is as follows: "Electricity also has reputation for the cure of these cases, but I have never had occasion to use it."

Muscular Rheumatism and General Neuralgic State.—Miss ——, aged 27 years, five years ago had an acute attack of rheumatism affecting in turn ankle, knee, shoulder, and heart. Her doctor told her that she had "neuralgia of the heart." She has had a continuous career of invalidism for the past five years. Had some uterine condition the nature of which is not now known to her, but after eighteen months of unavailing local treatment her ovaries were removed two years ago, and since that time she has wellnigh impoverished her family by "doctors' bills."

Since September last she has not had two weeks' freedom from alternating attacks of severe muscular rheumatism of all the muscles around the neck, shoulders, and chest, and what she called a sore throat. Sleepless with pain, worn out, and wellnigh utterly discouraged, she has had also to contend with neurotic disturbances that add to the intense agony of the rheumatism and neuralgias.

Liniments, lotions, and the best medical treatment she could obtain during the past five years have failed to improve her condition. Having heard that electricity might give her relief she gathered together her shattered strength and succeeded in getting to my office. She could just keep on her feet. Her head was drawn downward and to the right side, the muscles felt hard and rigid, those of the chest felt so constricted that she was unable to breathe deeply; her throat was swollen, she felt "sore all over," she had sciatic pains in the left leg; her thighs hurt her so much that she could not press them together; she felt intensely cold around the pelvis, quivered under the slightest draught, and was in an extremely pitiful condition. Her neck was swathed in absorbent cotton. She had on a winter cape with a high collar for protection from the cold, and a hat secured on her head with a veil. Her muscular agony was such that she was unable to remove either the cape or hat, and leaving them on she stepped to the static platform. This was on the 8th of March, 1897.

I applied, after a few moments of simple positive electrification, a hot negative spray to the spine, sides of the neck, and upper chest. Pretty soon the head began to straighten up, in three minutes she could take a deep breath, and after a hard-fought battle of twenty minutes she stepped from the platform with a sense of warmth and comfort all over. She had not a pain or symptom left anywhere. This was at 2:30 P.M. She left the office with her head erect and happy; she went home and remained comfortable the rest of the day, and enjoyed a good night's sleep. According to instructions she came again the next morning. Her condition had relapsed in only a small degree. The head was not drawn to one side nor were any of the muscles extremely painful. A second treatment was given with entire relief, and on the next day the third treatment was given.

The transformation wrought by these three sittings of static electricity would have convinced the worst sceptic that it was worth all the other agents in the materia medica for the relief of the worst type of muscular rheumatism if the aforesaid sceptic had witnessed the administration. It is seldom, however, that the neurologist or specialist in any other branch of medicine, who takes it upon himself to brush the facts of clinical experience aside, ever gets near enough to a static machine in

action to see it work, and as a matter of fact bases his statements on prejudice alone.

It will be possible to do a great deal to relieve the neurotic condition of this young woman by the simple aid of static electricity, after her five years' failure to attain health through the attentions of the gynecologist, the ovariotomist, and skilful medical prescribers. Regular treatment for a few months will help her greatly.

Case reported by Dr. W. C. Allen, Cranford, N. J.

Mrs. G——, a lady suffering from acute muscular rheumatism of the right deltoid and trapezius, which had continued about ten days and in the last few days showed signs of affecting the chest and back muscles, was given only one treatment with the positive pole attached to the spray electrode, and the current centred over the affected muscles. She went home that afternoon somewhat relieved, and when she awoke the next morning there was no pain, only a slight stiffness, and that soon left and did not return, and since then she has had many colds, and once an attack of rheumatism in the hip, which I cured in the same way, but there has not been the least sign of a return of the trouble in the shoulder.

Obstinate Chronic Lumbago and Similar Conditions, So Called.—The static spark is very certain to cure all these states that are confined to muscles, but its sphere of action does not extend so well to pains deep in the spinal articulations. It often happens that some final pain resists the breeze and spark in a case of chronic lumbago. When this is observed, and is evidently a joint and not a muscular affection, place the small Leyden jars in circuit and a large sponge or felt-covered electrode both upon the abdomen and over the rheumatic vertebræ. Make the posterior electrode positive, short-circuit the sliding poles of the machine, start the plates into rapid action, and draw the poles just sufficiently apart to produce agreeable sedation.

As relief advances, increase the current strength moderately. Length of sitting, fifteen minutes or until effect is complete. Repeat daily a few times, and thereafter as may be needed.

Muscular Rheumatism of the Arm and Shoulder.—*Faradic.*—Select a felt or sponge covered, flat electrode, about 3 × 4, wet it in hot water, connect it with the positive pole of an improved high-tension induction coil apparatus and apply it to the back of the neck.

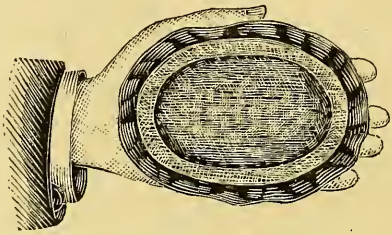


Fig. 360. Sponge-covered electrode.

Moisten an ordinary sponge-covered hand electrode in hot water, lubricate it with a little soap, connect it with the negative pole and place it upon the deltoid till the dose is regulated.

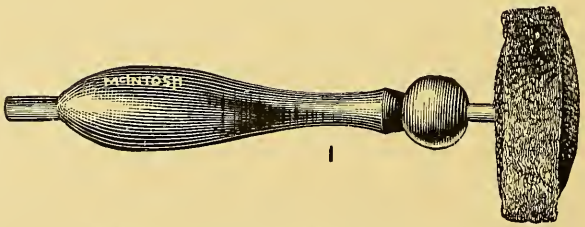


Fig. 361. Sponge-covered hand electrode.

Switch into circuit the 800 yard No. 32 secondary coil, the rapid vibrator and three or four cells. Increase the current strength through the secondary rheostat from zero until it produces a warming and comforting grasp upon the muscle fibres. Having regulated the current strength promenade the negative electrode very slowly over the affected muscles. Upon any point of special tenderness hold the electrode still for a moment and regulate the dose as needed until sedation is complete. In passing over motor points move the electrode

quickly beyond them so as to avoid causing the patient distress by maintaining a fatiguing tetanus, or reduce the dosage if needed.

Repeat daily until improved, then every second day until relief is complete.

Muscular Rheumatism of the Lower Extremities.—*Faradic.*—The principle of the application is exactly the same as that described above for the treatment of the arm, the only difference being the situation of the electrodes. In the treatment of the lower extremity the positive electrode may be placed under the sacrum or at the foot while the negative is promenaded over the limb, or both electrodes may be manipulated at the same time up and down the limb, upon the opposite sides, or the stabile electrode may be placed in any convenient situation.

Cramps in the Legs.—The static spark affords as certain and permanent relief from this affection as it does from acute myalgia. The relief begins immediately at the first sitting and after a few *séances* generally becomes established. Cramps in the calves occurring in women may depend upon pelvic conditions that require attention before the muscular spasms will be permanently relieved. Galvanic and faradic currents also affect this condition favorably, but the superiority of mild static sparks, which require no removal of clothing, is too obvious to be discussed. Rapidity of action and permanency of effects is also decidedly in favor of static sparks.

Muscular Rheumatism of the Lumbar Region or any Muscles of the Trunk of the Body.—*Faradic.*—Select a felt or sponge covered, flat electrode, about 3×4, wet it in hot water, connect it with the positive pole of an improved high-tension induction coil apparatus and apply it to the upper part of the spine. In the treatment of lumbago the patient may most conveniently recline face downward upon the operating table or a couch and the stabile electrode can be kept in place by a small shot-bag without attention by the operator.

Moisten an ordinary sponge-covered hand electrode in hot

Fig. 362. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

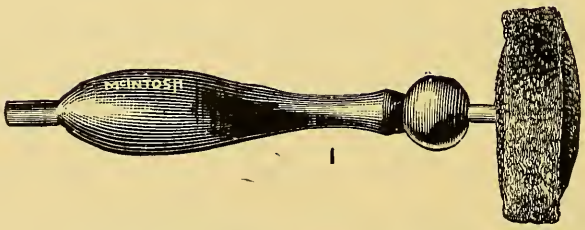


Fig. 363. Sponge-covered hand electrode.

water, lubricate it with a little soap, connect it with the negative pole and place it upon the lower spine to regulate the dose.

Switch into circuit the 800 yard No. 32 secondary coil, the rapid vibrator and four cells. Increase the current strength through the secondary rheostat from zero until it produces a warming and comforting grasp upon the lumbar muscles. Promenade the electrode across and over the affected area, dwelling for a moment upon each particular point of tenderness. Continue the application until all pain is relieved and the muscles are relaxed. In closing the sitting rub the spine briskly with a coarse towel. Repeat daily for a few times

until improved, and then every second day until recovery is complete.

Acute mild cases sometimes remain well after a single treatment, others after three or four treatments, and while chronic cases may require several weeks of treatment they will rapidly improve from the first application, and when the pains return they will become less and less severe until they finally cease.

When relapses occur the same treatment will again be effective.

Remarks upon the Treatment of Muscular Rheumatism by Electric Currents.—Galvanic currents are from their nature inferior to periodic currents of higher voltage in the treatment of muscular rheumatism. Faradic currents are effective and practically infallible, but they involve the removal of clothing, and I have often found this very inconvenient when the shoulder, arm and neck are affected. When the patient can hardly move his muscles he cannot easily undress. In the case of lumbago the removal of garments by women is sometimes more than a simple inconvenience. The advantages offered by static currents are:

1. No removal of any garment is required, and therefore no muscular movement of the patient is necessary to prepare for treatment.

2. The entire treatment can be given in about the length of time required to simply undress and dress again for treatment by moist electrodes.

3. No moist electrodes are employed with the usual static application.

4. Static electricity is generally regarded as the most efficient form of treatment for muscular rheumatism known to medicine.

While medicine aims to be a progressive science, yet it is one of the instances of its occasional lack of progressiveness in important therapeutic matters that it fails to spread among all practitioners the knowledge that there is one simple, practical and certain remedy for so common a disease as muscular rheu-

matism. This affection is often about as poorly treated as any ailment which causes pain to the human family. Many patients are allowed to suffer month after month, and endure relapses year after year, without ever having a curative remedy employed. Liniments and lotions might as well be rubbed on the doorpost, while a faradic or static current will produce decided therapeutic action in five minutes. There is no reason either in the theory or practice of medicine why physicians should cling to useless methods of prescribing for muscular rheumatism, inasmuch as no other remedy than an electric current properly applied is ever needed to give the patient complete and lasting relief. It is now fully half a century since this fact was known to be true of the faradic current, and it is more than a century and a quarter since static electricity demonstrated its unfailing certainty of action in curing every case of uncomplicated muscular rheumatism that was treated by a competent operator.

Wry Neck with Induration Following Abscess.—Upon the indurated side of the neck apply a negative felt-covered flexible electrode suited to the affected part. Place a similar positive electrode on the opposite side of the neck. Gradually increase the constant galvanic current from zero up to 15 mil. After five minutes again increase the current to the point of maximum tolerance between 20 and 30 mil. In ten minutes reduce the current to zero, switch the automatic interrupter into circuit and again increase the current strength until it produces forcible movements of the head, without pain or discomfort. In from three to five minutes reduce the interrupted current to zero and close the sitting. Dust the skin with toilet powder after removing the electrodes. Repeat the application every second day for a week, and later three times a week until improvement ceases.

Relief of pain, if it exists, and increase in mobility of the head begin with the first treatment. Improvement is rapid; a few weeks give brilliant results even in severe and chronic cases. The nervous state in which a child may be is also

greatly improved at the same time by this form of treatment. Sleep, color and general nutrition are favorably influenced even though the application of the current is entirely local.

To resolve, break down and absorb thickened tissues and chronic exudates always think of negative galvanic electrolysis, followed by an interrupted current to produce muscular contractions and promote absorption. Contractured muscles of any part may be treated upon the same principle.

Stiffness and Soreness of the Neck Muscles Following Acute Inflammations of the Neck and Throat.—When patients are undergoing extended treatment for chronic affections it not infrequently happens that some one of them will suffer from an intercurrent tonsilitis or myalgia of the neck or shoulder, and make the next appearance with a stiff and lame neck. Sometimes they think it is necessary to stop treatment and stay home while they apply liniments or mustard plasters for relief.

A moment's application of warm spray from the brass point electrode, followed by a few mild sparks from the same source, will give a sense of relief, comfort and satisfaction that can be equalled in absolutely no other way. The transition from aching discomfort to natural freedom of movement without pain does not take thirty seconds in some cases, and rarely more than five minutes.

If the case is recent, one, two, or possibly three brief applications will make the relief constant.

If the trouble has been neglected and has grown chronic, the treatment is the same, and the final result is the same, but it takes longer and requires several more repetitions.

In chronic cases the application may be made more stimulating by increasing the number of sparks applied.

CHAPTER XLV.

TREATMENT OF ARTICULAR RHEUMATISM.

General faradic treatment. Local galvanic treatment. General and local static treatment. Obstinate and unyielding articular rheumatism. Swollen and painful joints without acute inflammation. Rheumatic stiffness and partial paralysis. Sore and tender bony prominences. Rheumatic headaches. Rheumatic derangements of circulation and temperature. Obstinate lingering pains. Duration of treatment. Dynamos and rheumatism. Gonorrhœal rheumatism. Treatment of rheumatoid arthritis by combined galvanic and static currents. Clinical case illustrating special galvanic methods. Chronic synovitis. Treatment of arthritis by lithium cataphoresis.

Rheumatism.—*Faradic.*—For the general constitutional effect which may often be required in cases of rheumatic diathesis the only faradic method is *general faradization.* For the local relief of an affected joint a rapidly interrupted high-tension induction coil current may be passed between two electrodes situated on opposite sides of the joint, or in the

Figs. 364. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

case of the larger joints the negative electrode may be held stationary while the positive is slowly moved over the sensitive and painful area. The current strength must be regulated to produce a sedative effect. Duration of sitting about fifteen minutes.

Galvanic.—Swollen and inflamed small joints may be best treated by immersing them in a water-bath electrode contain-

ing bicarbonate of soda and connected with the positive pole, while the negative is applied to any convenient situation. Regulate the current strength from zero up to 5, 10 or more mil., according to the area of contact. Maintain the action of the current for about ten minutes and reduce to zero. This method gives great relief when pain is due to intense congestion or the pressure of fluids. The positive current drives some of the fluids away and relieves the tension of the skin.

In the case of large joints a large positive electrode can be fastened around the part with the negative at any convenient

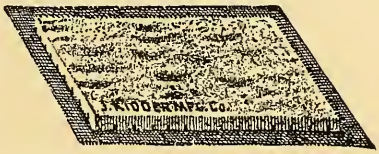


Fig. 365. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

site, and the same principle applied with a regulation of the dose to the point of producing comfort. In recent joint exudations the action of the positive galvanic current relieves the pain and stiffness, increases the mobility and accomplishes a great deal of good.

When the case is chronic the active electrode should be the negative, and after reducing the constant current to zero employ the interrupted galvanic current for a few moments to aid in dissipating the fluids released by electrolysis.

While the galvanic current does important work in the treatment of articular inflammatory exudations yet it is employed by only a few variations of method, so that not much need be said about it. The great majority of rheumatic patients need something more than a strictly local application of any current, and currents which can be applied for local and constitutional effects together without removal of the clothing assume an important place in the office treatment of patients. Such currents are furnished by the static apparatus, and their relation to the different manifestations of articular rheumatism will now be considered.

Static Electricity.—The different manifestations of rheumatism require some adaptation of the electrical method to the patient.

In the general rheumatic diathesis, with shifting pains and irregular symptoms at different times, the static part of the treatment aims at both local relief and at general alterative and nutritional effects. As ordinarily employed it cannot stand alone in the satisfactory treatment of patients whose rheumatism is general and subject to inflammatory relapses. The best results are obtained by assisting the action of electricity with diet and medication, and making the applications daily.

Apply positive electrification in its most efficient form for at least fifteen minutes daily. Add to this such localized breeze or spark applications as local symptoms may require, and as soon as the patient is accustomed to energetic treatment spark the spine and general surface with alterative positive sparks.

In all the varieties and stages of rheumatism, when any kind of medicine is known to do any good continue its use, for electricity interferes with nothing else and supports the remedy. Electricity also gives great relief to symptoms and renders valuable aid in overcoming the diathesis, but in subacute and chronic inflammatory articular rheumatism it must be pushed for effects and employed with discretion and not administered indifferently three times a week.

This is the least satisfactory kind of rheumatism to treat with static electricity. Do not apply sparks to any part within which a slumbering inflammation might be lighted up. The anodyne relief in such a state should be obtained from the breeze and sedative spray and in some cases frictions.

Obstinate and Unyielding Articular Rheumatism.—Cases of rheumatism of a well-known type sometimes persist in spite of all treatment. The patient has perhaps been through some years of experience with medication, proprietary cures, baths, possibly massage, probably galvanic and faradic methods, and finally lands upon the static platform with the rheumatism as

hearty and vigorous as ever, and the patient renewing hope for the tenth or twentieth time.

Treatment is pursued by the usual methods about three times a week, with immediate and grateful improvement. The headaches disappear, the muscular stiffness relaxes, sleep improves. In a couple of months or less the patient has very little further trouble "except in one place." If she "could get rid of that she would be all right."

Each application of ordinary sparks gives some relief and the general improvement has been very good, but finally, having no other pains to divert the attention, the patient concentrates her mind upon the single joint that is left to annoy her and she suddenly has a relapse. The routine treatment three times a week now seems as much of a failure as it previously seemed a success. The patient goes home with a few hours of relief before her and two days of suffering ere she comes again. The rheumatism seems resolved to die in the last ditch before it will surrender to static electricity or any other remedy, and these are the cases in which medicine seems utterly useless except for anodyne purposes. The disease localizes itself and intrenches in some impregnable Gibraltar around the hip-joint, for example, and surrounded by the unyielding fascia lata refuses to be driven out.

What then is the operator to do? Has static electricity failed? *Not always!* It has failed in the manner in which it was applied, but it has ammunition left and fresh reserves. About this time the patient is likely to say that she is pretty near discouraged and would do anything and submit to anything to get rid of the rheumatism. When this is the case the battle is half won.

Arrange with the patient to give you a better chance, to follow up the assaults which have given temporary relief until they hammer their way to the very gates of the citadel and compel an unconditional surrender. Arrange with him, or her, to come *twice a day* for treatment. Connect the platform with

the positive pole. Ground the negative pole and the brass point electrode to the gas fixture. With the machine in rapid action and a gentle use of the hot negative spray (made hot by having the patient wear suitable woollen garments) produce a preparatory warming up of the whole system. Then begin the genuine battle with the joint. Assault it by every device of stimulation, counter-irritation, and muscular contraction that can storm the tissues and conquer the disease.

First, with the brass point electrode and the patient postured in the most uncomfortable position in which the joint can be placed, increase the intensity of the spray around all the thigh, spine, and abdomen, and throw down shower after shower of stinging sparks as the point is swept over and across the tissues.

This is light artillery. Now bring up the heavy guns. The patient says she will "stand anything" if it will only do her good, and the sting of the spark is only for an instant, and these cases prefer it vastly to the continuous rheumatism. Exchange the point for the large brass ball electrode. Increase the current to its maximum energy. Pose the patient in different positions that will set up pain. Have her stand in a partly crouching position to make every muscle tense. At other times flex the limb with the foot upon a stool. Resort to every manœuvre that can develop pain, and in every position rain down upon the obdurate tissues such a storm of grape and canister that there is no alternative but capitulation.

Diversify the heavy sparks with intercurrent frictions over the site of the intrenched disease; allow the patient breathing spells of rest so that no real suffering will be caused by the application, and when she steps from the platform after about fifteen minutes' experience with the maximum capabilities of a well-handled static machine she will declare that she feels like a perfectly well woman. She will sleep soundly and restfully at night and will not only maintain a large part of the benefits of each treatment, but by these frequent and relentless repetitions will achieve as nearly a complete cure as it is possible for any-

thing on this earth to cure obstinate chronic articular rheumatism.

One, two, or four weeks of such treatment as I have here described will accomplish more than six months or a lifetime of routine puttering.

The operator, however, who undertakes such an energetic plan must have his patient in the proper frame of mind and must know precisely what to do and how to do it, for otherwise few patients would accept administrations of such apparent ferocity, although in the hands of a master of technique the treatment is perfectly tolerable and is not seldom interspersed with expressions of satisfaction on the part of the patient.

Leyden-Jar Current.—Still another reserved method which was first used by me four years ago embodies the physiological actions attributed to sinusoidal, alternating, high-potential currents and described in another section of this book.

Take any ordinary foot-tub and put in it a teaspoonful of sodium bicarbonate, a flat felt-covered electrode about ten inches square, and six inches of warm water. Place the medium or small Leyden jars in position for use. Carry an ordinary conducting cord between the negative jar and the terminal of the electrode in the foot-tub. Take also two glass jars or bowls in which the hands can be immersed above the wrist and fill them two-thirds full with the same solution as the foot-tub. Connect them with a bifurcated cord to the positive Leyden jar, which is of course the one connected with the negative prime conductor of the machine.

The patient sits in an ordinary chair with the bare feet in the tub and a wrap of some kind over them to protect from draughts. One of the jars is placed at each side and the hands are immersed. This gives three water-bath electrodes, which furnish a contact that cannot be surpassed or even equalled in any other way.

Short-circuit the sliding poles of the machine. Start the plates into very rapid action, and gradually draw the poles apart

until the patient experiences a comfortable thrill in either the hands or the feet.

Having regulated the current strength to comfortable tolerance, the application may be continued fifteen or twenty minutes.

It subjects the entire muscular and circulatory system to a fine vibratory massage. As this practically includes everything in the body but the bones, it exercises a marked effect upon nutrition, metabolism, and elimination, as set forth by Apostoli.

The method is applicable to gout, rheumatism, uric-acid and all other states in which general nutritional and alterative action is desired. This action is along the lines of a gradual improvement of the patient's condition and has the advantage over sparks that it causes little or no sensory effect. It, however, does not relieve local pain immediately as does the spark or breeze, and these may both be employed for symptomatic relief during the early stages of treatment by the Leyden-jar method.

This plan of treating rheumatism accommodates itself especially well to cases of an inflammatory character, and when the condition is general throughout the body instead of presenting a constant localization. It may be expected to give satisfactory results, or at least develop a very encouraging improvement, in about twenty daily treatments. If the case is so obstinate that it has resisted other measures, and if this plan affords reasonable encouragement, it should be persisted in one, two, or even three months, for those who have spent years in battling with chronic articular rheumatism should not refuse a small modicum of patience and perseverance to any remedy that is helping them.

Case reported by Dr. Franklin H. Clark, Cleveland, Ohio.

Mrs. H——, married, aged 40, three years ago was attacked with acute articular rheumatism affecting both knees, confining her to bed for two years; also had frequent attacks of lumbago.

During this time all the remedies in drug kind were tried with very little benefit.

After forty applications of the static sparks (these treatments were made daily) the patient could walk fairly well and at the end of three months was discharged cured.

Case reported by Dr. W. S. Watson, Fishkill, N. Y.

Mrs. W——, aged 37, had had a severe attack of rheumatic arthritis with resulting contracture of left leg, leg flexed to an angle of at least thirty degrees, firmly ankylosed, and of some four months' standing. The joint had been treated by massage thoroughly without any apparent relaxation or benefit. The case was treated by applying the Leyden-jar current, using one sponge under the foot of the affected side, and the other sponge about the joint for five or seven minutes, followed by the long spark from the ball electrode to the contracted ligaments and about the patella.

Fourteen treatments were given, one every third day, when the woman had so completely recovered the use of the limb as to go about freely without the assistance of cane or crutch and was entirely well, notwithstanding that when she came for treatment she was unable to get her foot from the floor.

Swollen and Painful Joints without Acute Inflammation.— To general positive electrification as before, add positive sparks to the knee, elbow, ankle, shoulder, or any other affected part. Begin cautiously, and if no aggravation is caused make the sparks of gradually increasing strength until they reduce the swelling, remove the pain, lessen stiffness, and finally restore all of mobility and strength that appears to be attainable. In these cases, as in all others in which the resources of electric currents are far superior to routine external applications for reflex effects, use no liniments, blisters, tincture of iodine, ichthyol, or any other local, superfluous, or useless application.

In these chronic joint cases static is more effective than galvanic or faradic electricity, and is vastly quicker and easier to apply. The results soon teach patients instinctively to prefer it after a few experiences with "family batteries" and home treatment.

Repeat the sittings as often as necessary to promote the best obtainable state of relief. If pain is severe and the relief from one treatment does not at first last even from one day to another, sittings should certainly be daily, or even twice a day, until the relief lasts longer. It is useless to try to "cure" rheumatism with any remedy that delays its second dose long after the action of the first has ceased. My experience leads me to infer that many failures permanently to improve articular rheumatism with electricity are the results of too extended intervals between "doses."

Rheumatic Stiffness and Partial Paralysis.—To the usual tonic electrification with the positive pole with which each treatment is generally begun add a suitably vigorous application of positive sparks until the stiffened muscles relax and their nutrition and functions are restored.

At each sitting entire relief from any present pain should be secured, with progressive improvement in mobility.

Posture the patient with the ankylosed joint under extreme muscular tension, and if it is the ankle, knee, or hip, have him stand with the entire weight of the body exerted in unison with the sparks. By this method the greatest possible mobility will be obtained. If an arm is affected, exercise the muscles near the joint with slow contractions by a slowly interrupted Leyden-jar current, or by winding the chain around the forearm and arm in succession, connecting it to the positive pole while the negative is grounded, and exercising the arm vigorously by the author's method of sparking the prime conductor.

Apply the sparks slowly for several minutes with intervals of rest to avoid fatigue. The sense of lightness, buoyancy, endurance, and general well-being imparted to heavy, stiff, and inactive limbs by this method is far more appreciable to the patient than the results of any other form of treatment known to medicine.

To establish improvement—which may at first appear to be very rapid and later very slow—the early sittings should be

near together, but can be lengthened to every second or third day as gains permit.

Sore and Tender Bony Prominences.—In the treatment of rheumatic cases with sparks we not infrequently find that some small area of prominent bone at the knee, ankle, hip, elbow, or shoulder joint, or some of the knuckles of the fingers, will be very sore and tender to touch.

The spark is not suited to parts which are not covered with muscular fibres, and is contraindicated. Some physicians have used the spark and complained that it aggravated rather than relieved. So will twenty grains of quinine aggravate a congestive headache to which it is not suited. The proper thing to do is to apply the right remedy, which is the positive static breeze.

During the sitting, with the patient connected with the negative pole, ground the brass point electrode, and have the patient bend the joint so as to expose most sharply the seat of tenderness. Then concentrate upon the part a very vigorous sedative spray, with the plates revolved rapidly, and the electrode swayed gently over the surface, just near enough to make the brush discharge luminous. A couple of minutes is usually a sufficient time. Repeat at each sitting during the course of treatment until sufficiently improved.

Rheumatic Headaches.—I usually devote a couple of moments' attention to a head breeze during the general treatment of rheumatic patients who report habitual headaches. If the headache is present at the time of treatment I continue the application longer until it is entirely relieved, but as a rule nutritional improvement soon takes care of this symptom without any special head treatment at all.

The relief from head pains, which often appears marked by the end of the first week of treatment, is one of the reasons why patients who have long taken medicine in vain appreciate the practical merits of static electricity.

Rheumatic Derangements of Circulation and Animal

Heat.—Some of these cases have habitual cold hands and feet which do not readily warm up in bed at night even with a hot-water bag against them. If the extremities are still cold after the preceding applications I close the sitting with a few very mild and clear-cut positive sparks to the sole through the shoes.

Have the patient keep one foot flat upon the metal tray connected with the negative pole and lift the other foot from the platform with the sole presenting to the operator. After directing about three single and slow sparks to the centre of the most fleshy portion of the plantar muscles, exchange the feet and repeat the process upon the other. Do this two or three times with each foot.

Avoid the sensitive edges of the foot, the heel, toes and toe-nails, and strike the spark directly in the centre of the sole. This not only warms the feet at the time but by a few repetitions tends to keep them permanently warm, or capable of being readily warmed again by the circulation, if they are exposed to cold weather.

Obstinate Lingering Pains.—When rheumatism has been apparently driven from all the system except perhaps a single joint from which it refuses to be dislodged, I cease, after a reasonable time, to persist in the above methods, but pass through the obstinate part a very rapidly interrupted high-potential current from the small Leyden jars or from my coil apparatus; and if this fails or the indications point to the galvanic current, I employ it before discharging the case.

The sedative and alterative effect of these currents upon pain deep-seated between articulating surfaces is much better than sparks will produce.

As a general rule the relief of pain and muscle stiffness associated with chronic rheumatism will be most successfully achieved by the author's habit of posturing the patient during treatment. Two minutes in this way will often do more for the patient's comfort than ten minutes without, and as a matter of fact some patients who are readily given very satisfactory

results by this aid to treatment have previously failed to find "electricity" in other hands beneficial at all.

Duration of Treatment.—The time required in any given case cannot be stated in a book but can be fairly estimated in practice. I have had a patient come to me, after eight weeks in bed with a pretty heroic course of internal and external treatment, and in seven sessions with static electricity cease to have any of the pain, which had before been so great that he could scarcely endure coming to the office. The slightest movement of his elbow and shoulder was almost intolerable before the first treatment, and the lower extremities were partly affected. Within a week from his fourth treatment he was riding his bicycle with comfort.

I have seen very chronic cases without inflammatory tendency lose more than half their average pain after the third treatment and desist after fifteen or twenty applications, feeling that they were about as well as they could reasonably hope to be.

As acute inflammatory cases of rheumatism confined to bed are entirely aside from the subject of static electricity, and as many of our cases come to us after some years of suffering and various methods of treatment without success, it is fair to consider that two or three weeks for the relief of the most favorable cases, with an allowance of from two to four months for the full treatment of medium and severe cases, is not an unreasonable period for the accomplishment of satisfactory results.

From the experience gained from treating a considerable variety of cases with electricity the practitioner will cease to regard the prognosis as a matter of guesswork, but will find that he can very accurately determine, from his first examination of the patient and at his first treatment, into which one of four classes a given case will fall, and whether he will be able to obtain quick, good, slow, or poor results. He will also be able to distinguish to what extent the rheumatic condition is not amenable to static electricity and will support his treatment by other measures.

While there are occasional demands for the local uses of both galvanic and induction-coil currents in the treatment of rheumatic conditions, by far the major portion of general treatment can be preferably done with static. When other currents will do as well in theory, static will do far better in practice by achieving the same results in a shorter time and without the trouble of any disrobing, either partial or complete.

Although medicine is an extremely necessary part of the treatment of inflammatory types of rheumatism, yet in many chronic cases which have never been acute, and in which medication has proved persistently useless, I prescribe no drugs whatever and the patients thrive very well on static electricity every second day or three times a week, after sufficient relief has been obtained to permit the longer interval.

Clinical Remarks.—It is well to remember that pain in the foot may be something besides rheumatism, neuralgia, or gout.

A patient was once referred to me for "galvanism on his heel"—which had pained him constantly for about nine years. He had been treated two entire years with static sparks and had received no benefit whatever. Another physician had told him that he needed "galvanism." I sent him to a shoemaker for support for his *flatfoot*, and afterwards removed the ache which lingered in the arch with a few applications of a positive static spray, administered to both feet at once, for eight minutes at a sitting, by the brass point electrode, fixed upon the standard. He obtained total temporary relief at each application, which gradually lasted longer and longer, and after four *séances* became permanent.

This case illustrates one of the alleged "failures of static electricity to cure rheumatism."

As a side contribution to the clinical study of the dynamic effects of electricity in rheumatism I will include a reference to workers in electric light and power stations. In the winter of 1894–95, while engaged in some experimental work in the laboratory of a central station, I had several talks with the jan-

itor of the building, a man about sixty years of age, who had in his time, he said, been a great sufferer from rheumatism. He was very much interested in the subject and said that for thirty years he had never long been free from rheumatic pains until the last three years. During these three years he had been employed in and around electric-light stations, and had been free from rheumatism. He asserted that not a single workman in the station had the disease, and it was the general belief among the men that the immunity was due to the influence of electricity from the dynamos.

The facts were made the subject of inquiry through an electrical journal having a large circulation among light and power interests, and an attempt was made by the author to collect data from men of practical experience in this field. The replies elicited were very few in number, but one of them was as follows:

To the Editor of ——:

I saw in your paper an article asking for information in regard to what effect dynamos have on persons who have rheumatism. I will give you my own experience, and if it will be of any use to your correspondent I will be glad.

I was born and raised in Massachusetts and can hardly remember the time when I did not have rheumatism. From the age of ten to nineteen years I suffered intensely with it. Then I came to San Antonio, Tex. For two years I was free from it, although out of doors in all kinds of weather. Then it returned again. About this time I obtained work in an electric-light station in Galveston, Tex., which was the first one in this State I believe.

For four years I was constantly at work in this line, two in Texas and two in Detroit, Mich.

During all this time I was not troubled with rheumatism.

After this I was four years on a ranch in Western Texas, in the most healthful part of the State; here the rheumatism returned again, but not as when I was a boy in Massachusetts.

For the past six years I have been again employed around dynamos, and do not have rheumatism, although it is a very common complaint here and I am exposed to all kinds of weather.

I am not around the dynamos to exceed two hours out of the twenty-four.

CHARLES H. EDDY,
Superintendent Electrical Department of the Brenham Compress, Oil, and Manufacturing Company.

In central-station work there is generally no direct application of the current, the workmen simply performing their duty in an atmosphere continually in vibration and electrified from the dynamos and wires. Theoretically we can imagine that not only rheumatism but numerous other states of ill health would be benefited by a residence in an atmosphere that conduces to molecular and functional activity. The physiological effects of currents of high potential and high frequency upon protoplasmic metabolism have been pretty thoroughly investigated and determined during the past five years. They are summarized by Apostoli as follows:

Clinical tests upon more than a hundred patients show that these currents exert in the majority of cases a most powerful and generally beneficial action upon diseases due to *slackening of the nutrition*, by accelerating organic exchanges and combustion. This is proved by analyses of the urine made by Dr. Berlioz, of which the following is a brief *résumé:*

The quantity becomes more normal; the products of organic waste are better eliminated. The increase in combustion is shown by the diminution of uric acid, while the percentage of urea is generally increased. The relative proportion of these two substances changes under treatment so as to reach in general the figure of $\frac{1}{40}$. The elimination of the mineral products is also changed, but in a manner less marked.

When daily *séances* are given, each lasting fifteen minutes, we may generally observe in patients submitted to the influence of these currents the following modifications in their general condition. We mention them in the order of their occurrence.

Return of sleep.

Increase of strength and vital energy.

Increase of gayety, of power for work, and ability to walk.

Improvement of appetite, digestion, etc.

In short, general progressive improvement.

This general improvement often manifests itself after the first *séances* before any local influence is apparent, and before any change has occurred in the urinary secretions.

Local pain and trophic changes are often more slowly affected by these currents, and at times they are entirely refractory for a longer or shorter period and in such cases the same currents must be applied locally by contact with the electrodes, for general electrization by any form of current must be localized at the seat of local pain.

The diseases which have appeared to derive most benefit from this therapeutic agent belong to the arthritic class: rheumatism gout and diabetes.

In conclusion, the currents of high frequency and of high tension introduced into electro-therapeutics greatly increase the field of action of medical electricity. *They furnish general medicine with a new and valuable means of treatment, capable of modifying more or less profoundly the processes of nutrition through the vasomotor system and exerting a powerful action upon all living bodies subjected to their inductive influence.*

As the statements of Apostoli are now universally accepted as the most authoritative in the field of modern electro-therapeutics I need advance no further argument to explain the *rationale* of the action of static electricity in rheumatism.

The static machine has been from the earliest day to the present time the chief of high-frequency, high-potential sources of medical currents, and in furnishing also the powerful localizing influences of the breeze, spray, and spark, it stands in value far ahead of any substitute "alternating" apparatus that has yet been devised. The one other available form of high-frequency medical apparatus stops in its facility of application and therapeutic effects about where the most active methods of static action begin.

Gonorrhœal Rheumatism, so Called.—In this class of cases, which come to the office with joint pains and without signs of acute inflammation, I detect no practical difference between them and other cases of rheumatism in the indications for treatment by electrical currents.

Under general nutritional applications of static electricity, and localized applications of the breeze, spray, or spark, adapted to the given case, patients with this clinical form of rheumatism do about as well as others.

If some inflammation is present in any particular joint the local application should be either the sedative positive breeze, or the small Leyden-jar rapidly interrupted and mild current, poured steadily into the part between two ordinary sponge-covered electrodes, such as are used with faradic treatment. In

estimating the prognosis in rheumatism the tendency of this disease to relapse must not be forgotten.

Woods and Fritz, in their "Practice of Medicine," thus set forth the treatment of this disorder: "The treatment of gonorrhœal rheumatism is very unsatisfactory. We have never found the salicylates, colchicum, the iodides, or the mercurials to exert a distinct influence for good. In the acute cases, rest, fixation of the joints by splints and blisters, or the application of the thermo-cautery over the joints, constitute the major part of the treatment. In chronic cases careful attention to the general health, the best possible hygienic surroundings, the administration of tonics and of arsenic, and the use of massage and passive movements, comprise about all that can be done by the physician. The utmost importance should always be attached to the local treatment of the genito-urinary organs; the obstinacy of the disease often depends upon the existence of a slight chronic gleet. The surgical treatment of the inflamed joints, by opening and irrigation, is said to have yielded satisfactory results."

Static electricity does infinitely better than this, and will relieve the patient satisfactorily even if it does not always completely cure him. All the remedies suggested above are inferior to the static current in any stage of the disease.

Rheumatoid Arthritis.—Owing to the generally hopeless medical view of this "terrible ailment," it is considered here more fully than some other diseases.

It is one of the cases in which treatment should be directed to the patient rather than solely to the local joint lesion. The disease is progressive and the prognosis unfavorable under medical treatment, but it is my belief that an improvement of fifty per cent in the local condition and vastly more in the general health can be affected by the skilful use of galvanic and static electricity.

Rheumatoid arthritis may in the manner of its invasion be acute or gradual, and the subjects of it may be rheumatic,

gouty, phthisical, scrofulous, neurotic, or have suffered from some local injury, or from some utero-ovarian lesion; but whatever the variety of disease, there will generally be found a nervous system weakened by anxiety or suffering, depraved digestion, spinal irritability, and anæmia.

I quote the following remarks by Armstrong because they contrast well the usual therapeutics with the simple, practical, certain, and cheering treatment to be presently described.

> Important points are: (1) Early diagnosis; (2) recognition of the special variety of the disease with which we have to deal; (3) the use of remedies which will act not only on the local joint mischief, but also upon the original cause of the disease, upon nutrition generally, and especially upon the nervous supply of the joints.

[Can any one name drugs having the above actions wherewith to cure rheumatoid arthritis? The author quoted avoids this point and continues:]

> As a rule I have found the following drugs and methods more or less harmful, as are all forms of treatment which exercise a debilitating influence; soda salicylate, potassium iodide, alkalies generally, colchicum, bromides, Turkish, Russian, and vapor baths, and very hot immersion baths, whether mineral or plain. Sulphur, guaiacum, and ichthyol have given negative results.
>
> I have found the following remedies of service: Salicin, quinine salicylate, iodine, iodide of iron, colchicine salicylate, cimicifugin, viburnum, hydrastin, cannabis indica, red marrow of bone, hypophosphites, nux vomica, sumbul, blisters, and cod-liver oil.

My own experience has resolved itself into about the following plan of treatment, which is modified as different cases require:

If any redness, tenderness, and inflammatory swelling are present in any of the joints, immerse the hand deeply to above the wrist in a jar filled with warm water with a half-teaspoonful of bicarbonate of soda added. The salts of lithium are advised by some authors, but I no longer think it worth while to attempt cataphoric medication with this remedy. The results are equally good without it.

Into the prepared jar drop the tip of the positive conductor. If one hand only is affected, the opposite hand in a second similar water-bath may be made negative; but as both hands are usually in the same stage of disease I make both fluid electrodes positive with a bifurcated cord, and press a negative sponge or felt covered electrode, about 3x4 inches area, upon the back of the neck. This requires the least possible derangement of the person's clothing.

Increase the continuous galvanic current gradually from zero up to about ten milliamperes, and maintain this dosage until the most comfortable and complete sedative state in the joints is produced. This may take ten or twenty minutes, but I persist until the effect is secured.

Repeat sittings daily if possible during the first week, or until the pain, swelling, and redness subside. This will usually require a few *séances* only, but the number will of course depend upon the severity and obstinacy of the condition.

At the earliest moment that a mild spark perturbation within the tissues can be set up without exciting fresh inflammation in the joint, I abandon the galvanic current and the trouble of moist electrodes, long *séances*, and purely local action for the greater utility and far-reaching effects of static administrations.

The patient is now seated upon the negative platform with her hands open upon her lap. The dorsal surface is first uppermost. With the brass point electrode and the positive pole grounded to the chandelier I apply a strong, cooling, sedative breeze, concentrated to almost a spray, passing the electrode over each hand within an inch or less of sparking distance. Then up the arm, around the shoulders which are often stiff and painful, down the spine, around the knees which also often ache, and ankles, and to any other locality where stiffness, soreness, or pain resides. When headaches occur, or when the mental state is depressed, a head breeze is included in the *séance*, and when the above-described portion of the treatment is all accomplished within ten minutes I change the platform

connection to the positive pole and close the sitting with an additional five or eight minutes' nutritional, positive, general electrification.

With each succeeding static treatment after the first the composure of the patient will increase so rapidly that the spine and all large joints and muscles affected with pain and stiffness may soon be vigorously treated with mild sparks. In many cases this general constitutional treatment is of much more importance to the comfort of the patient than is any improvement that could possibly be made in the hands alone in the first half-dozen sittings, especially if applications are made no oftener than three times a week.

There is a definite increase in strength, both nervous and muscular. The entire arms gain in mobility and ease, and improvement in sleep, appetite, digestion, and general nutrition takes place, and the mental state becomes hopeful.

During the subsidence of the last lingering tenderness in the small joints of the fingers the passage from the spray application to mild sparks directly upon them must be slow and gradual, although strong nutritional sparks may be given the rest of the body with impunity.

As soon as tolerance develops in the finger joints the hands are thoroughly treated with sparks of gradually increasing strength, going over every joint and muscle of both palmar and dorsal surfaces.

I have indicated above the cautious manner of initiating treatment when sufficient tenderness and active arthritis are present to require care. But the stage of the disease when the patient first appears for treatment is often such that very strong sparks can be given at once without distress, and in that case the necessity for delay in applying them is absent. The hand, however, in health feels acutely the keen sensation of static sparks, as do all parts of the body which are not well cushioned with muscles to soften the impact of the blow; and when tenderness is exaggerated by disease it must first be lessened and

the change from sedative to stimulating treatment must be gradually made. The precautions required to comfortably administer strong static sparks to the arthritic hand become quickly apparent to the user of the ball electrode, and an inquiry as to the sensations of the patient or even a glance at the expression of the face instructs the experienced operator in the regulation of current strength. These sittings are now usually repeated only three times a week.

In the course of time, which may vary from one to two or three months with different cases, the general condition will have improved so far that the patient "feels well," can use the hands and arms for many helpful purposes, and is entirely free from general symptomatic disturbances, even though the critical observer may see little reduction in the anatomical deformity of the fingers.

I now shorten the static application by omitting the first portion of the *séance* and substitute exercise of the hand and arm muscles by a slowly interrupted Leyden-jar or high-tension induction-coil current and two ordinary sponge-covered hand electrodes.

These are first held in the palm of each hand without regard to polarity, except that I generally reverse it so that each hand gets about as much of one polar action as the other, and the current strength is increased until the whole extent of each arm is influenced.

The electrodes are then localized upon the muscles of the forearms and hands, and particularly upon the wasted muscles of the deformed joints. At first three or four slow contractions to each group of muscles are sufficient, and the number is increased as strength and endurance are developed, in the same manner as in treating ordinary paralysis.

The rate of current interruption should be about seventy per minute, and fatigue and painful contraction are always to be avoided upon the common-sense principles of all rational electro-therapeutics.

Any medication that appears indicated can of course be prescribed at the same time, but these patients have usually "tried" medicine and become hopeless about it. Some declare that they cannot take cod-liver oil, and as a matter of fact our clinical experience teaches us that patients who are given no drugs at all get along very hopefully on electro-therapeutics alone.

I continue to alternate the local treatment of the hands between the induction-current exercise of the muscles, and the resolving, alterative, and tonic action of the strongest sparks which the patient can now receive, together with general positive electrization as long as the systemic state requires it.

Prognosis.—As few persons will continue a long course of treatment without interruption it is difficult to say what the ultimate possibilities of correcting an advanced claw deformity would be; but if we judge results by the general gain in comfort, strength, and increased ability to employ the crippled hands and all other affected parts, we find that long before the hands show any marked return of symmetry the patient is expressing both gratitude and satisfaction over the improvement. It is probable that the best results obtainable by any of the resources of medicine can be best and most quickly obtained by the methods described above, when they are applied with due skill and perseverance. Electricity can without doubt successfully displace and far exceed in value all other remedies for rheumatoid arthritis.

The following case is inserted to illustrate a special galvanic method of interest:

Rheumatoid Arthritis.—On March 20th of the present year I was called to Mrs. L., 60, married, and mother of several married healthy children. Found her in a wheel chair suffering from arthritis of the larger joints of the extremities; those of left side being most affected. She had been disabled for nearly two years and had not been able to walk a step, or lift an ordinary book, for over a year, and could not on account of weakness of left knee extend the left leg, nor on account of weakness of wrists extend either hand. The muscles of the extremities were wasted and flabby; but her face had a good color, her mind was unimpaired, and her appetite was good.

She had been treated by several physicians, some of them eminent, and one had administered galvanism so strong as to be very painful, for a period of six months, but she had grown steadily worse. Beside such similar treatment to what she had previously received, I gave her galvanism daily for two weeks, and since then have given her four treatments a week. The strength of the current has been uniformly 6 mil., as this is all she can comfortably bear. (In such cases and in most cases, I must say that I consider a painful current is usually injurious.)

The current has always been delivered with a rheostat; one electrode is placed at the feet; length of *séance* about ten minutes; during the first five minutes a hand electrode is moved over the spine with an ascending current for four minutes and finishing with a descending current for one minute; then, during the last five minutes of the *séance*, the hand electrode is placed in the left hand with the right upon that or both hands and wrists and occasionally both elbows as well are wrapped in a wet towel to which the hand electrode is applied, and for four minutes of this time the current is given in an upward direction and during the last minute in a downward direction.

This method fits my notion and it fits the patient's, for she is getting well. On one occasion I finished the *séance* with an upward current, and without the patient's knowledge, and that night she did not sleep, and this was the only restless night she has had since I have attended her. The joints are gradually resuming their natural appearance and she is gaining strength and flesh. She can now extend the left leg and the right hand nearly, and she can walk across the room several times unassisted, and can even walk down a couple of steps and seat herself in her carriage without assistance. (*Woolsey.*)

Treatment of Arthritis by the Electrolytic Introduction of Lithium.—From a careful reading of the reports of this method of treating affected joints with the galvanic current, and from personal experience, I am not only not convinced that the method possesses superior value, but in my own practice I have discarded it as not worth the trouble it requires. To any physician who has a complete equipment which places at his command the entire resources of galvanic, faradic and static currents a great many of these exceptional methods which are designed to eke out the value of the galvanic current

in the treatment of affections in which other currents do better work become unnecessary and may be ignored.

Chronic Synovitis.—Static electricity offers two efficient methods of treatment—sparks and the Leyden-jar current.

Insulate the patient negatively, ground the positive pole and the brass ball electrode to the gas fixture. Apply mild sparks to the affected joint, or stronger ones if they are well tolerated. Request the patient to bend and pose the joint to bring out the local pains during treatment, and in each position spark the tissues until relief ensues. Repeat every second day until improved and then three times a week until benefit ceases.

If the part is still sensitive and sore to the touch sparks will not be tolerated, and the Leyden-jar sedative-tonic application may be made far more agreeable. Apply two sponge-covered hand electrodes to the opposite side of the joint, connect the smallest jars in circuit with a short spark-gap, rapid action of the plates and a mild current.

Fig. 366. Fine felt or sponge covered electrodes—assorted sizes with soft rubber insulating backs.

Pass one electrode very slowly over the area affected while the other is held stationary. The question of polarity is not important, and if the negative electrode is somewhat larger than the positive the sensation of the two will be about the same.

Continue the application until all stiffness and pain are re-

lieved. If any particularly sensitive spot is found, hold the positive electrode upon it, with a regulation of the dose at the point of comfortable tolerance, until sedation is complete.

The constant galvanic current may also be employed with the electrodes on opposite sides of the joint. Regulate the current strength to comfortable tolerance (from 10 to 20 mil.).

CHAPTER XLVI.

TREATMENT OF PARALYSIS.

Clinical precautions in treatment. Forms of paralysis. Electro-diagnosis. Principles of treatment. Treatment of muscular atrophy. Paralysis of sensation. Treatment by static and faradic currents. Facial paralysis from cold. Treatment of post-diphtheritic paralysis. Paralysis and atrophy of the deltoid, trapezies, etc.; galvanic, faradic and static methods. Obstetrical paralysis of infants. Lead paralysis from lead poisoning. Infantile paralysis following poliomyelitis. Facial spasm. Paralysis agitans.

Remarks on the Electrical Treatment of Motor Paralysis.—Moderation in beginning the electrical exercise of any paralyzed muscle is necessary. Increase the amount gradually.

Persistence is often essential to success.

Judgment is required at all stages of treatment.

Never tire a weakened muscle, but seek to awaken nutritive activity before developing strength. Never hurt the patient.

Never attempt to treat any form of paralysis with the common unscientific crude vibrator faradic current and never instruct a patient to get a family battery and treat himself.

An understanding of correct dose regulation is the prime necessity in all therapeutics. Electricity is not a panacea for paralysis *per se*. It is the most important single remedy for curable forms of paralysis, but requires skilful prescribing at all times.

Paralysis.—In theory not only is there no remedy for paralysis equal to electricity, but treatment by this remedy is reduced almost to an exact science. In *practice* the treatment must often be tedious and persistent or the results will be disappointing. There are some kinds of paralysis which electricity will cure, some which it will not cure but will amelio-

rate, and some in which it will benefit the general health of the patient without acting directly upon the affected muscles.

Classification of Varieties.—

1. CONSTITUTIONAL. Paralyses which occur as sequelæ to variola, diphtheria, typhoid fever, syphilis, rheumatism, gout, etc. Poisoning by lead, mercury, arsenic, phosphorus. Hysterical paralysis.

2. CENTRAL. Paralysis caused by some pathological lesion of one of the great nerve centres, commonly shown in hemiplegia, paraplegia, and their various complications.

3. PERIPHERAL. (1) Caused by action of cold on the nerve supplying affected part.
(2) Mechanical injuries of muscle or nerve.
(3) Pressure, as from a tumor, a crutch, etc.
(4) Injury or destruction of a nerve from suppuration of a part, from over-use of muscle or set of muscles.

4. REFLEX. Caused by irritation in a remote part, secondarily disturbing the nervous centre. For instance, paraplegia caused by the presence of worms in the intestinal canal, or by disease of kidneys, uterus, etc.

The character of the paralysis is generally made clear by ordinary methods of diagnosis. Much is made in books of the value of electro-diagnosis in determining whether the paralysis is central or peripheral.

Place two ordinary hand electrodes upon the muscles of the

affected limb and increase a slowly interrupted coil current from zero until it makes the muscles contract to any degree. Make exactly the same application upon the opposite and healthy limb, and if the contraction is about the same and the paralysis has existed for more than ten days the electro-diagnosis shows it to be, not in the muscle, but in the nerve *centres*, which have lost their power to conduct contracting impulses to the muscles.

If the muscles will not contract to a faradic current, or will contract only a little, the *muscles* are affected instead of the nerve centres. There are many refinements of statement about electro-diagnosis, but the above contains the essential facts. The importance of knowing the nature of the paralysis relates to the prognosis, for the principle of treatment varies little. No other measure which will benefit the patient should be neglected and electricity will not interfere with anything else that is done.

Its function is twofold: to improve the patient's general health if this is impaired, and to assist in restoring the abolished muscle function of contraction.

An *interrupted* galvanic current will make atrophied muscle fibres contract when they are too degenerated to respond to a coil current, which has little amperage. A *constant* galvanic current will warm, nourish and strengthen a cold, wasted muscle to a limited extent, but in all such cases the muscle must be made to contract as soon as possible, or the paralysis will never be cured.

To make muscles contract we have four varieties of electrical stimulus: the interrupted galvanic current, the static spark, slowly interrupted Leyden-jar currents and induction coil currents. If atrophy has taken place and the lesion is cerebral or spinal the interrupted galvanic current will probably provide much better means of making the muscles contract than the faradic coil, but in all cases of paralysis the proper thing to do is to find out which current awakens the most ready response and employ it.

The minor forms of paralysis due to cold should be first treated by a warming, relaxing, anti-congestive application of a rapidly interrupted induction current upon the same plan as that which secures faradic sedation with the high-tension induction coil apparatus. Following about five minutes of this application, exercise of the muscles may be gradually developed by interrupting the same current with the slow vibrator adjusted to a rate of about 70 per minute.

Caution is always advisable at the commencement of each case to avoid over-taxing weakened muscles by too vigorous stimulation. Short sittings with slow and mild contraction at first can be gradually increased in the amount of exercise until the muscles endure very thorough treatment without fatigue.

Something of the results will depend upon the skill of the operator, the faithfulness of the patient in attendance for treatment and the methods employed, as well as upon the character of the lesion.

With respect to prognosis it may be said concisely that when the loss of power is in the muscles, and the centres and path of conduction are unimpaired, almost every case can be either rapidly or slowly cured.

In all cases of mechanical injury to the nerve trunk the prognosis will be good if the anatomical integrity of the nerve is either maintained or can be restored. Any injury which destroys the path of conduction obviously renders a cure impossible. The same remarks about prognosis apply equally to disease of the nerve trunk.

The great class of cases in which many ignorantly and in vain look to electricity for a "cure" includes all those dependent upon injury to the motor centres. What electricity can do for these forms of paralysis is practical and useful, but not miraculous.

If the patient comes to the office from confinement in the house, with a nervous system shattered by either suffering or anxiety, with muscles wasted by lack of exercise, and the whole body in a weak state, the immediate effects of general positive

electrification and mild positive sparks to the spine and muscular surface in general will relieve pain, promote sleep, give passive exercise to the muscles, renew vigor and tonicity, and in two weeks' time produce an apparently remarkable change for the better.

As a matter of fact this simply *begins* the treatment of the paralysis, and it is after this point is reached that disappointment, founded upon a lack of information, ensues. The *patient* has been benefited by lifting his general system up to the level of his actual disease, and treatment has simply removed the debilities of house confinement and his previous sufferings. The actual treatment of the paralysis dates from this time.

The prognosis depends upon three things:

If the central lesion is an effusion which will reabsorb, or an injury which time will make better, the prognosis will be a gradual improvement in proportion as the central impediment disperses. These cases of hemiplegia and paraplegia can be improved with great satisfaction by electrical exercise of the muscles, while, if left to time alone, the paralysis would long linger after the effusion was absorbed.

If the central lesion or injury is of a character which retrogrades, the road before the patient is all downhill, and electricity can produce only temporary benefit, or assist the patient to be more comfortable if the paralysis is attended with suffering.

If the injury within the head or spine has reached a maximum of damage and thereafter remains in a chronic, quiescent state, the patient will, if left to time, witness a very gradual improvement, and perhaps, after many years and a great variety of medical treatment, reach a point where his muscles are useful in proportion to the existing state of the central cells and fibres.

If such a patient is properly treated by electricity before the chronic effects settle into complete apathy far better results can be obtained in much less time.

If the paralysis results from lead, gout, rheumatism, hysteria, syphilis, or any form of constitutional poisoning, the best ap-

plication is persistent, oft-repeated, and thorough nutritional and alterative treatment with electricity, together with iodide of potassium, mercury and other drugs (as severally indicated) to neutralize the poison and eliminate it from the system.

It is, however, often astonishing to witness the improvement in cases of mineral poisoning in patients who attend the clinic and who receive no medicine whatever.

After the first general improvement, in central types of paralysis which will either improve slowly or present atrophies unfavorable to treatment with static sparks, the general administration for nutritional effects should be continued, but the local exercise of the muscles may best be carried on with a slowly interrupted faradic or Leyden-jar current, and the application of a pair of ordinary moist electrodes.

In some cases this would involve a removal of garments which the crippled patient cannot easily remove in an office, and in these cases substitute methods must be employed until improvement reduces the extent of the crippling and makes more thorough treatment possible.

When the arm is affected it is comparatively easy to bare part of the surface, wind a chain around it, and exercise the muscles by the author's method described in a previous section.

In estimating the value of static electricity in all cases of paralysis it must be remembered that its sphere of action relates chiefly to its influence upon functions, and that it is not possessed of properties which will supply new nerve cells, remove a cerebral clot, repair the ravages of chronic inflammation, cut down excessive formation of connective tissue, or prevent mechanical pressure upon vital structures.

If the treatment of any form of paralysis is undertaken with static electricity, and the patient is able to attend for office treatment, it is certain that there is no stage too early to properly begin. A great part of the damage done to the multitude of cases we see in general practice was done by long waiting for inflammation to subside and by other delays which put off

the application of electricity. The longer a muscle is deprived of its functional activity the more it wastes, and the longer it takes simply to regain the unnecessary loss.

In the acute stage of apoplexy from cerebral hemorrhage I would unhesitatingly advise affording the patient the benefit of a daily administration of a sedative, anti-inflammatory, positive head breeze to reduce the cerebral hyperæmia, as soon as he could be safely allowed to move about and attend for treatment. It would also act as a sedative-tonic, and aid in maintaining the tonicity of the entire system, so that when the time arrived for exercising the paralyzed muscles he would have suffered the least possible amount of physical and mental degeneration. Notwithstanding that no opportunity has been permitted me to put this view into actual practice, I nevertheless believe it to be thoroughly advised. I also believe the application of galvanic currents to the head in an attempt to absorb a clot to be fruitless for good and a dangerous practice.

Treatment of Muscular Atrophy.—The treatment of atrophied muscles is the same in principle, no matter what group is affected, but the current employed and the clinical results differ materially. A muscle which is wasted secondarily to a central lesion may have no substance to work upon with the static spark or the ordinary slowly interrupted faradic current. The constant galvanic current is the only form of electricity which possesses the power to improve nutrition without muscular contractions, but the rapidly interrupted high-tension induction coil current will also warm the tissues, increase the blood supply and improve nutrition if the case is not incurable.

When muscles are wasted from inaction or peripheral causes they respond readily to the slowly interrupted faradic current, Leyden-jar current and to static sparks.

Recent states are easily improved, but long-standing conditions, especially the atrophies following anterior poliomyelitis in children and hemiplegia and paraplegia in adults, improve very slowly, and it is practically useless to treat most

chronic cases except for the relief of symptoms and improvement of the general health.

Paralysis of Sensation.—Numbness, tingling and various degrees of loss of sensation are observed in a variety of cases associated with neuralgia, motor paralysis and other diseases of the nervous system. Sensation generally returns along with other improvement in the ordinary course of electrical treatment and particularly when the patient is given the benefit of static administrations.

If the numbness demands special attention the most direct and effective restorer of normal circulation and sensation is the static spark. It is harmless, can be applied to any part of the body without exposure, requires no removal of clothing and is rapidly curative when the lesion is not of a hopeless character. It improves however nearly all cases which cannot be radically cured.

Seat the patient upon the static platform connected with the negative pole, ground the positive pole and the brass point electrode to the gas fixture. Start the machine into moderate action and sweep the point of the electrode over the part just near enough to discharge intermittent showers of fine needle sparks. Repeat a succession of these small sparks for a few minutes until sensation is aroused. In a mild case it may require but a single moment. The local application for this purpose can be made at the close of other indicated treatment, for the relief of the sensory symptoms is usually only a minor part of a course of treatment required by the patient.

The above refers to the simplest type of cases. In other cases in which the paralysis is more complete and affects a limb, or occurs in the form so often seen in locomotor ataxia when the legs below the knees will be almost insensible to even the strongest stimulus, an entirely different method is pursued.

In these cases the platform is connected with the positive pole and the patient is subjected to general nutritional treatment with powerful percussive sparks over all the region in

which sensation is dulled. No other method can be employed which will accomplish more than this, and whatever improvement is obtained during the general treatment must be accepted as the best relief that any means at our command will afford. The amount of bombardment which the soles of the feet and lower limbs of such a patient will welcome with a sense of comfort would astonish a patient with normal sensation.

The so-called faradic brush commonly recommended is of course the same in principle but differs so much in degree that no one who is equipped with a static machine need employ it. The puny faradic spark which will not pass through an air gap much thicker than a postal card is an infantile stimulus com-

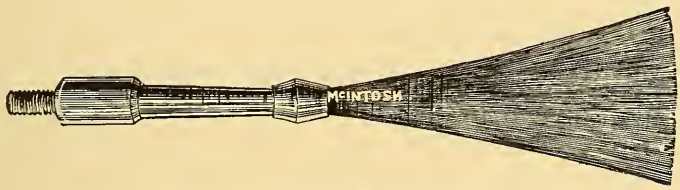


Fig. 367. Metallic brush electrode.

pared with the high potential static sparks which drive through the resistance of five or six inches of air.

Facial Paralysis from Cold.—Select one of the larger size

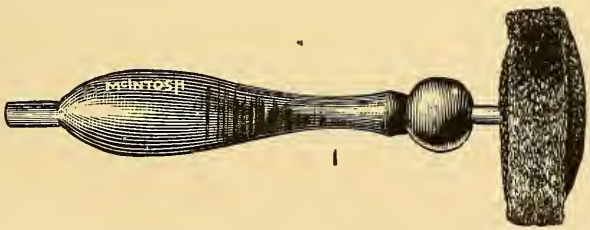


Fig. 368. Sponge-covered hand electrode.

ordinary, wood-handle, sponge-covered electrodes, moisten it in hot water and connect it with the positive pole of the high-tension induction coil apparatus. Have either the patient or an assistant press this electrode upon the back of the neck.

Connect a similar electrode with the negative pole and press it upon the affected side of the face directly in front of the lower lobe of the ear.

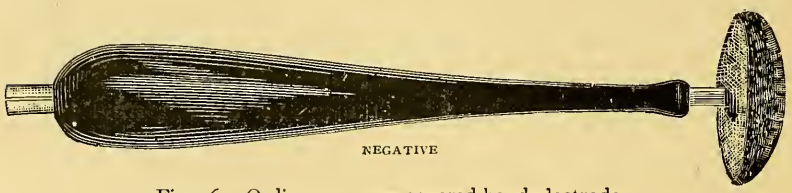


Fig. 369. Ordinary sponge-covered hand electrode.

Switch into circuit the entire compound coil (blending both primary and secondary), making a total of nearly 8,000 feet of wire. Also switch into circuit the finely adjusted rapid vibrator, three cells and the secondary rheostat. Gradually increase the current strength through the rheostat from zero until the tissues are strongly grasped beneath the negative electrode.

Pour into the muscles a steady stream of this warming, comforting and relaxing high-tension current, and after a couple of moments slowly slip the negative electrode over all the different portions of the paralyzed side of the face below the eye without removing it from firm contact. As the electrode leaves the motor points in front of the ear the current strength may be increased.

After five or six minutes increase the resistance in the secondary rheostat until the current is at zero and pass the negative electrode to the frontal region with the positive brought forward to the front of the ear. The forehead is very sensitive, and the author's secondary rheostat which *controls all secondary coil currents of whatever strength so that the dosage may be evenly and agreeably increased from zero up to tolerance* is of practical value in the treatment of this affection.

Apply the modified current to the frontal region for about two minutes, then slip the negative electrode again to the lower portion of the face and move the switch arm from the rapid to the slow interrupter. Regulate the current strength

through the rheostat so as to cause strong comfortable contractions at the rate of about 70 per minute. At the first sitting make only a few contractions over the various portions of the affected side of the face and neck. The entire time employed is from ten to fifteen minutes.

Repeat sittings daily if possible, or every second day, until recovery is well advanced, and in recent cases this will be at the end of a week or ten days. Chronic and neglected cases require longer treatment. During the latter part of improvement three times a week is sufficiently often.

After the first two or three sittings the selected coil should be the 1,500 yard No. 36, a little later employ the 800 yard No. 32, and as the function and endurance of the muscles improve under the progressively increasing amount of exercise given at each sitting the more local acting shorter coarse coils may finish up the last few treatments.

The same method is employed in cases of facial paralysis due to any other cause, but, if irreparable damage to the nerve supply from a surgical operation is the cause, only partial improvement will be gained instead of a radical cure.

Post-diphtheritic Paralysis.—To hasten the general convalescence of every child who has passed through this prostrating disease there is no single remedy so valuable and so acceptable to the patient as electricity.

To establish preliminary improvement seat the child upon the static platform connected with the positive pole, ground the negative pole and start the machine into moderately rapid action. Administer general positive electrification for fifteen minutes daily for the first week, and then three times weekly.

After the first few sittings stop the positive electrification at the end of ten minutes, change the platform rod to the negative pole, ground the positive pole and the brass point electrode and apply a sedative-tonic positive breeze to the spine and head for about five minutes.

As soon as the child becomes accustomed to treatment gradually add a few very mild sparks to the spine and muscles

of the limbs by occasionally throwing the spray electrode sufficiently near to discharge a spark.

If the muscles of the throat are affected a few mild sparks from the point electrode can be applied during a single minute to the larynx, both sides of the neck and the muscles at the base of the skull.

If the muscles of the arms or lower limbs are affected it requires but a short period of treatment to progress to the point of applying mild sparks to all the extremities and the spine with the brass ball electrode. Medical tonics, open-air exercise and all other sensible means of promoting recovery will be more efficiently assisted by skilfully handled static electricity than by any other therapeutic agent. The long and slow convalescence following malignant diphtheria, a period which sometimes drags along for several years, may be brought to a comparatively speedy finish in the manner above described. It is impossible to speak too strongly of the benefits of static electricity during convalescence from exhausting diseases.

While no other current equals the general benefits of generastatic electrification in this class of cases, yet induction coil currents may be employed by both general and localized methods for nerve and muscle effects. The common family faradic battery is indeed employed in hundreds of these cases, but is utterly worthless from the standpoint of scientific electrotherapeutics. The money spent for cheap faradic boxes, even upon the order of physicians, is thrown away.

If the muscles of the vocal apparatus are affected moisten two ordinary sponge-covered hand electrodes and apply one

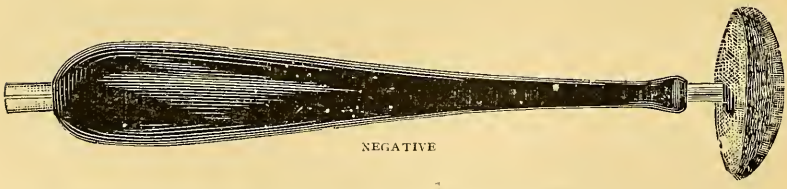


Fig. 370. Ordinary sponge-covered hand electrode.

upon each side of the larynx. Connect them to the opposite poles of high-tension induction coil apparatus. Switch into circuit the 1,500 yard No. 36 coil, the rapid vibrator and three or four cells. With the electrodes firmly in position on the opposite sides of the larynx increase the current strength from zero by means of the rheostat until the grasp upon the tissues is strong but painless. The patient should attempt swallowing movements and practise inaudible sounds while the current is passing.

After about five minutes of this application switch from the rapid to the slow vibrator without making any other change in the current or electrodes.

Next increase the current strength to the point of causing vigorous single contractions at the rate of about 80 or 100 per minute. Exercise in this way the muscles upon each side of the neck, and during succeeding sittings alternate the situation of the positive and negative electrode. Repeat daily or every second day for one or two weeks, and three times a week thereafter until improved sufficiently.

If the faucial muscles are affected, place a positive sponge-

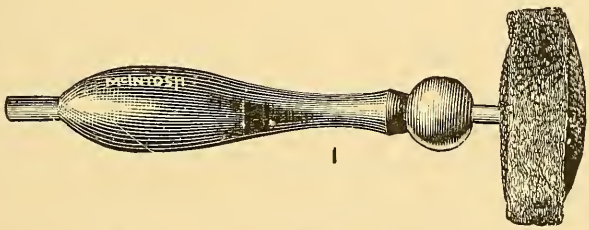


Fig. 371. Sponge-covered hand electrode.

covered electrode upon the nape of the neck and connect with the negative pole any electrode with a small metallic tip. This

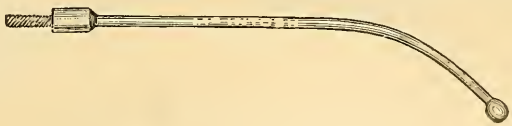


Fig. 372. Laryngeal electrode.

may be used either bare or covered with absorbent cotton moistened in hot water. Adjust the 800 yard No. 32 coil and slow interrupter so that the current strength will be just sufficient to contract the muscles vigorously when momentary contacts are made with the negative electrode. Through the open mouth of the patient touch the tip of the electrode to the different muscles so that they are caused to contract a dozen or more times at each sitting.

If the lower limbs are affected seat the patient upon any moist flat electrode, or upon the metallic reservoir foot electrode, which can be filled with warm water and closed with a cork. Connect this with the positive pole of the high-tension induction coil apparatus. Employ the combined No. 21 coil and the 800 yard No. 32 coil, the slow vibrator, adjusted to not more than 100 periods per minute, and with a negative hand electrode applied to any part of either limb regulate the current strength through the secondary rheostat until proper muscular contractions are caused.

After regulating the dosage exercise the different muscles up and down the limb. After the first sittings the number of contractions and the current strength employed can be gradually increased as the tissues develop tonicity. At the first sitting cause but two or three contractions to each group of muscles and at no time cause either pain or fatigue.

Immediately after completing the slow contractions switch from the slow to the rapid vibrator, freshly moisten the hand electrode, lubricate it with a little soap and whip it rapidly

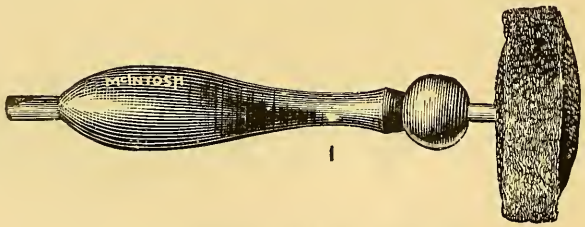


Fig. 373. Sponge-covered hand electrode.

over the motor points of each limb in turn. This imparts a sensation of elastic buoyancy and produces a marked circulatory and nutritional benefit.

If the arms are affected the same principle may be applied

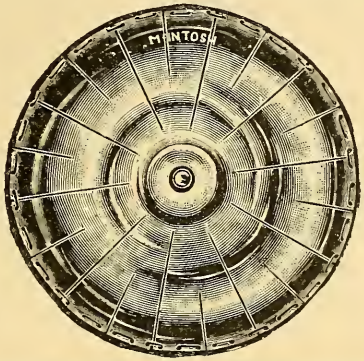


Fig. 374. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

with the positive electrode (a sponge-covered pad of convenient size) placed upon the cervical spine.

If the physician unfortunately does not possess the useful static apparatus and desires to obtain a general tonic effect from a coil battery without the tedium of general faradization, the patient may be placed upon a stool and a negative hand electrode pressed over the epigastrium. Connect this electrode with the negative pole of the induction coil apparatus.

Select an ordinary sponge-covered hand electrode, moisten it in hot water, lubricate it with soap and connect it with the positive pole. Switch the 800 yard No. 32 coil into circuit with the rapid vibrator and an E. M. F. of three or four cells. With the anterior electrode in firm contact and the positive upon the cervical spine increase the current strength from zero until the patient feels a sensation of warmth and a little tingling of the skin. Slowly move the electrode down the spine, and if sensation entirely ceases at any point increase the current strength until it is again felt. Next move the electrode somewhat rapidly over the muscles of one side of the back and if the contractions caused are vigorous but not painful the dose

regulation is complete. Next promenade the electrode with moderate speed up and down the entire spine, and at any point of marked tenderness, especially common in the lumbar region, hold the electrode still until the pain is relieved. Then renew the labile application, and after about five minutes devoted to the central line of the back, sweep the electrode a little more rapidly across the lumbar region and over the muscles of each entire side and around the shoulders to produce a stimulating and tonic effect upon the circulation and substance of the tissues.

From eight to ten minutes is sufficient time for the entire application. Remove the electrodes, dry the back and close the *séance*. Repeat about three times a week or according to convenience of both physician and patient.

It cannot be too often stated that the ordinary faradic battery, with its toy coil and coarse interrupter, is not suited to the proper treatment of these cases, and as employed by the laity does not constitute therapeutic treatment.

In a case reported by Jackson, the patient, a young lady aged eighteen, was brought to his office in a carriage and supported by two persons.

Six weeks previously she had a severe attack of diphtheria, but in three weeks was able to be about. She soon noticed difficulty in swallowing and her speech became affected. The legs grew weak so that she could not stand and she was much depressed by her condition. She tottered and fell in attempting to walk without support. There was marked weakness of the muscles of the arms and legs with numbness and pricking. Entire absence of knee and elbow jerk. No ankle clonus, could not hold a cup in her hands without its falling. Had a sensation as if something remaining in the hands after putting object down. Flesh soft and flabby. Muscles on the left side of the fauces were markedly paralyzed, speech thick and nasal, complained of a knot in the back at the waist line. Weight 113 pounds, appetite fair, bowels normal and examination of urine revealed nothing.

She was put under treatment at once with static electricity, negative insulation and positive breeze. Massage and sparks

were applied to the weakened muscles and to the spine. Duration of *séance* twenty minutes. Treatments were given at intervals of from two to six days, and in two weeks she was able to walk without falling and to go upstairs alone.

At the end of three weeks treatment was supplemented by the galvanic current to the spine with the positive electrode at the back of the neck and the negative on the sacrum with five to ten mil. for ten minutes, followed by the static treatment. The patient made rapid progress, and at the end of two months was able to dance, though the knee jerk was still absent. The voice had lost its peculiar nasal quality and she spoke without difficulty.

By the end of the third month she reported herself better than before the diphtheria. Spirits gay and cheerful. Improvement continued, but she was not discharged with a normal knee jerk and complete recovery until six months from attack. She had gained decidedly in flesh, and all her functions became healthier than before her sickness.

A marked effect of the treatment was the regulation of her menses, which had previously been too frequent and excessive as well as painful.

Paralysis and Atrophy of the Deltoid, Trapezius, etc.—*Galvanic.*—If the muscles do not respond to the faradic current at first examination the treatment may be begun with the galvanic current, which is suited to cases of advanced atrophy.

Moisten a felt or sponge covered electrode, about 3×4, in

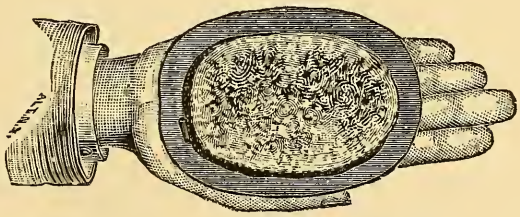


Fig. 375. Sponge-covered flat electrode.

the usual hot-water solution of bicarbonate of soda and place it upon the back of the neck. Connect it with the positive pole. Prepare a similar but somewhat smaller electrode in the same manner, connect it with the negative pole and apply it upon the deltoid. Gradually increase the constant galvanic

Fig. 376. Felt or sponge covered flat electrode, assorted sizes.

current to about ten mil. and slowly promenade the negative electrode over the area of the atrophied muscles. After about fifteen minutes reduce the current to zero and close the sitting.

After each sitting of this kind make a momentary test of the contractions which can be produced by a moderately strong interrupted galvanic current, and as soon as these can be obtained exercise the muscles for three or four minutes at the close of each sitting. In making these contractions adjust the interrupter to a rate of about 70 periods per minute.

The galvanic current is rarely required in these cases and is chiefly a preparatory step in the treatment of advanced atrophies.

Faradic.—As soon as results can be obtained by an induction current switch the rapid vibrator, the 800 yard No. 32 coil and three cells into circuit. Employ the same electrode as above but lubricate the negative electrode with a little soap. Increase the coil current through the secondary rheostat from zero until it produces a decided tingling and a forcible constant contraction when it is held upon a motor point of any of the affected muscles. To discover a motor point no chart is required. Simply pass the electrode along the surface, and it cannot go far in any direction without find-

ing a motor point. They are as easy to locate as the rock which the skipper discovered when his boat ran aground.

Promenade the negative electrode somewhat rapidly over the affected muscles with the rapid vibrator current to produce a stimulating nutritional effect upon the circulation. In five or eight minutes move the switch arm from the rapid to the slow interrupter adjusted to a rate of about 80 to 100 periods per minute. Increase the current strength until the contractions are sharp and firm but entirely comfortable, and exercise the muscles for several minutes in proportion to their gradual increase in strength and endurance.

Follow the essential rule of moderation at first with a gradual development of energy as the tissues respond.

Repeat treatment daily until good contractions are obtained, and continue the applications every second day until nature can take up the process and carry it on. During the last portion of a course of treatment twice a week will be sufficient.

Static.—Both the galvanic and faradic applications require access to the surface of the skin. The static current does not. The patient may be treated from the start with mild, positive sparks both to the affected muscles and to the entire spine. The sparks may gradually increase in number and vigor. If the condition is amenable to faradic treatment it will be amenable to static treatment, and by the use of the small Leyden jars employed in the manner described above for the coil current the physician may accomplish the same thing in about the same way if he desires to do so.

To Relieve the Pain and Stiffness of Muscles, Sequelæ of a Paralytic Attack.—Before producing contractions of paralyzed muscles the first step is to relieve acute and distressing symptoms. To quickly relieve pain, coldness and the stiffness which are most often complained of there is of course nothing equal to a warming, sedative and nutritional electric current, whether the face, arm, lower extremity or back is affected. All currents are useful. The constant galvanic and the

rapidly interrupted high-tension current poured steadily into the part are wonderfully efficacious. The various resources of static electricity cover the same ground, often with less trouble, unless the part affected is the face or hands, which are already exposed for contact of the electrodes.

These nutritional currents warm, relax and energize the stiff, cold and aching muscles. They surpass local applications of drug-prescribing as sunlight surpasses the glimmer of a star. Thousands of physicians torment their patients with useless procedures when the most satisfactory remedy has been known and employed by thousands of other physicians for many years. This is one of the contradictions of the healing art.

With either the constant galvanic or rapidly interrupted high-tension coil current apply the positive electrode nearest the centre above the affected muscles and apply the negative at the extremity. The choice of electrodes and situation will be self-evident to the practitioner upon seeing the individual case.

After pouring the steady current regulated to comfortable tolerance through the tissues for about ten minutes produce a few muscular contractions by a slowly interrupted current at the close of each sitting.

The static method consists in the application of a strong positive spray followed by brief counter-irritation and later by mild positive sparks.

The subsequent treatment of the case proceeds upon the principles of restoring functionation to any paralyzed muscle. (See other sections.)

Obstetrical Paralysis of Infants.—Have the mother or nurse seated upon a chair and, holding the child upon her lap, press an ordinary sponge-covered hand electrode upon the back of the child's neck. Connect this electrode with the positive pole of a high-tension induction coil apparatus.

Remove the clothing from the affected arm and connect a

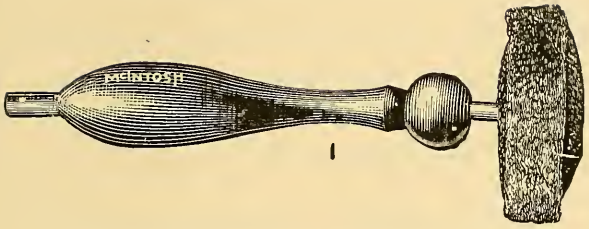


Fig. 377. Sponge-covered hand electrode.

sponge-covered hand electrode with the negative pole, and in addition to moistening this with hot water lubricate it by rubbing it two or three times over a cake of plain toilet soap.

Switch into circuit the slow vibrator adjusted to a rate of not over 100 interruptions per minute. Begin with the 1,500 yard No. 26 coil at zero and gradually increase the E. M. F. until vigorous but entirely comfortable contractions extend along any groups of muscles upon which the negative electrode is placed. By the practised operator's touch and eye the vigor of these contractions (without fatigue or pain) is easily regulated without regard to the age of the child or to questioning. In no case of the treatment of a paralytic muscle is it necessary to ask for information from the patient in order to properly regulate the strength of current. Feel the muscle contract and you will need no other guide to the efficacious dose.

When properly managed a child may sleep during the entire treatment, so absolutely free from distress is the action of this regulated current.

After correctly adjusting the dose (with the negative electrode in any convenient situation for the purpose) the various muscles of the arm, forearm and hand are exercised in detail by causing each to contract several times.

As a rule begin the application of the labile electrode in the upper region near the stationary electrode held upon the cervical spine. Exercise the deltoid and adjacent muscles by shifting the negative electrode slowly over every part of the

surface. No knowledge of motor points on anatomical charts is necessary.

As the lower muscles of the arm are approached by the negative electrode request the mother to shift the positive from the spine to the middle region of the deltoid and later to the extensor and flexor surfaces of the forearm while the hand muscles are exercised.

A little further regulation of the current strength will be necessary when the current is concentrated upon the smaller muscles.

Skill and experience in the manipulation of current strength and the labile electrode will advance results in these cases more rapidly than the absence of them. The galvanic current, no matter how employed, is inferior to the above method. During the progress of improvement the shorter lengths of the 36 and 32 coils may gradually succeed each other.

As the causes of this form of paralysis may vary from temporary pressure or effusion to laceration of nerve fibres, or more serious traumatism, the prognosis for any individual case cannot be stated in advance.

Usually several months of treatment with three or four applications per week will be required if the condition has resisted ordinary non-electrical methods. A case dependent on serious laceration should be treated persistently until no further benefit can be observed.

In unskilful hands there may be only partial recovery after several years of improper treatment, and this class of cases should never be turned over to nurses or parents for electrical administration ; they are not competent to act the part of experts in electro-therapeutics. After treatment is suspended improvement goes on with the growth of the child as a rule.

Paralysis from Lead Poisoning.—Promote elimination of the lead by iodide of potassium internally.

Static.—Insulate the patient upon the static platform connected with the positive pole. Ground the negative pole and

administer simple general electrification for about ten minutes. Stop the machine and transfer the rod to the negative pole. Ground the positive pole and the brass ball electrode and again start the machine into moderate action. Apply mild sparks over the spine, abdomen and upper and lower extremities. Follow these general nutritional sparks by a few locally upon the paralytic muscles.

Repeat sittings of a similar character every second day until sufficiently improved. Increase the number and vigor of the sparks as the tolerance progresses. Stimulation of the functions of the spine is as important as the local sparks to the muscles.

Advanced cases of lead poisoning will also complain of neuralgic pains, which may be removed at the same sitting and in the same way.

If the patient is a painter and continues to follow his occupation he may be considerably improved and kept able to work by returning for treatment whenever he has a relapse.

Galvanic.—In the absence of a static machine a slowly interrupted galvanic current may be used to contract and exercise the affected muscles.

Place a felt or sponge covered, flat electrode, about 4 × 6, upon the back of the neck if the wrist drops, or have the patient sit on the electrode if the lower extremities are affected.

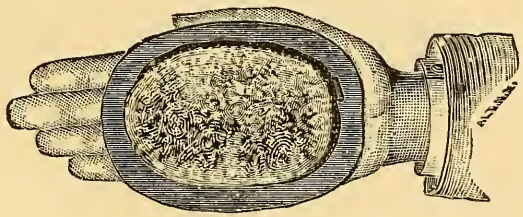


Fig. 378. Sponge-covered flat electrode.

Apply a negative hand electrode to the affected muscles, regulating the current strength to cause the best contractions possible without fatigue or pain. Repeat as directed above.

There is, however, no form of current so satisfactory in the treatment of these patients as the static, for they generally require a good deal of treatment, and this may be most quickly and conveniently given by the aid of the static apparatus, while with other currents it is tedious to give a general electrization.

Infantile Paralysis Following Poliomyelitis.—Improve the warmth and nutrition of an atrophied and cold limb before attempting to contract atrophied and paralyzed muscles. Treatment must be directed to the spinal lesion, the nerve trunk and the wasted muscles. The chief current is the galvanic. The patient coming to the office for the first time for treatment may be in the stage following the acute inflammation, when for a few weeks the process remains stationary ; or may have undergone a few months or a year of degeneration ; or may be in the final chronic stage of total paralysis and deformity.

The prognosis varies in proportion to the lapse of time after the invasion and the extent of the muscular atrophy. The principles of treatment are about the same. The time required to produce the best results places the patient in the class of orthopedic cases which are about as tedious as any in the practice of medicine.

Moisten a felt or sponge covered, flat electrode, about 3 × 6,

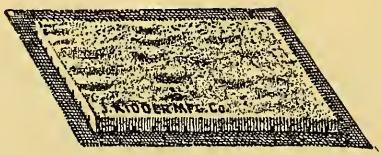


Fig. 379. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

in a hot-water solution of bicarbonate of soda, connect it with the negative pole of the galvanic battery and place it under the affected portion of the spine. Prepare a felt-

covered, flat electrode, about 4 × 6, in the same manner, connect it with the positive pole and place it over the abdomen. Gradually increase the constant galvanic current until the point of comfortable tolerance is reached (five, ten or fifteen mil.) and maintain it steadily for from five to ten minutes.

Next reduce the current to zero and either sit the patient upon the positive electrode for convenience or retain it on the upper spine. Select a sponge-covered hand electrode, moisten it in the bicarbonate of soda solution, lubricate it with a little soap, connect it with the negative pole and stroke all the nerve trunk and the affected muscles with a mild current which is comfortable to the tender skin. Devote about ten minutes to this portion of the treatment.

Treatment should be repeated daily or at least every second day. If the child is in an advanced stage it is useless to at first attempt contractions which will only further exhaust the muscles. Nourish the limb first with the constant galvanic current and add to this suitable prescribing and frictions at home. When the muscles will contract to an interrupted galvanic current make very few and very mild contractions at first. In the course of improvement the muscles may respond well to the galvanic stimulus and finally respond to faradic.

Static Electricity.—While this current will do little or nothing for atrophied and useless muscles it will give passive exercise to other muscles which are not paralyzed and increase the control of the patient over the limbs. As this exercise can be readily given with a few static sparks and general improvement of the health promoted by local applications to the spine without removing any of the clothing, it is often a useful procedure.

These cases, often sadly injured by neglect, will tax the patience and resources of both physician and parent. Without persistence for months there may be little or no improvement in a chronic case. Skilful management will make the static spark acceptable to children. I have had one case—a boy of three and a half years, who cried every time a galvanic

application (even 5 mil.) was made, but who was a good soldier with the sparks and accepted them regularly.

Facial Spasm.—This is the most frequent and practically the most important form of spasm. The spasm may be tonic or clonic or both combined. It may arise from various causes. Although electricity has been used in every conceivable manner it has proved absolutely inefficacious in the vast majority of cases. (*Leszynsky.*)

The local application of galvanic and faradic currents referred to by the above author have proved inefficacious. As however this incurable condition may be accompanied or aggravated by a debilitated state of the general health and an impaired nervous system, we have in static electricity a very useful method of improving their nervous tone and thereby somewhat lessening the spasmodic infirmity.

Seat the patient upon the static platform connected with the negative pole and adjust the head breeze electrode about fifteen inches above the vertix. Ground the positive pole and carry the same chain to the electrode. Start the machine into moderate action and administer this sedative-tonic application for ten or fifteen minutes.

After two or three sittings add a local application to the spine, especially to the cervical spine, and gradually increase it from a mild breeze at first to a strong spray a little later and finally to mild sparks.

Repeat these applications about three or four times a week for one or two months. The decided improvement thus obtained will last for a comparatively long time and may be obtained again in the same manner when needed.

Paralysis Agitans.—Electricity will not cure these diseases under ordinary circumstances, but if the patient's general health is below par and the condition is thereby aggravated, static electricity will always afford the amelioration attendant upon an improvement in health, and in some cases a good deal more.

I have treated an elderly and neurasthenic woman who had suffered from paralysis agitans for thirty years, and whose handwriting was barely legible, and after seventeen administrations of static electricity have seen her improve in general health, regain nerve tone, and write a letter which was about as steady as persons seventy-five years of age in ordinary health would be able to write.

The methods employed and proper in all such cases are simply those which will improve the general condition and relieve any other local symptoms which may exist, pain, etc.

The main part of the benefit is derived from positive electrification and a tonic breeze to the spine and centres of the cranium. If the arm muscles are flabby and weak from lack of exercise I add slow muscular contractions with an interrupted current for the purpose of increasing the tone of the fibres, and this usually ameliorates in some degree the tremor or agitation.

CHAPTER XLVII.

TREATMENT OF WRITER'S CRAMP.

Typewriter's and telegrapher's paralysis. Acute or chronic fatigue of special muscles. Treatment of the early stage of writer's cramp with complete cure. Treatment of middle stages with symptomatic relief and either marked improvement or entire cure. Treatment of paralytic stage of writer's cramp. Results obtainable. Treatment of cramp and spasm.

THE author has devoted considerable time and study to the treatment of these irksome affections. In chronic cases of true writer's cramp rest is not even palliative. I have seen telegraphers who could not touch a key even after rest of from one to sixteen years. The ordinary therapeutic suggestions of text-books are practically useless. Some method of exercise, or wrist appliance, or massage may serve to relieve a few cases, but others "try everything" and despair at last.

Owing to an increasing infirmity in my own arm I examined, in 1893–94, into the merits of every treatment described during the past thirty years. I can discover no authentic method which will cure writer's cramp in the brief period of two or three weeks, nor can any method be discovered by me which will enable the patient to successfully treat himself at home.

Much has been claimed for methods of specific massage which were described by a German writing-master in 1877, but after personal interviews with him in this country, and witnessing a demonstration of his method, it has been impossible to verify his alleged results. It is probable that his method is valuable to himself, but unless others are able to obtain the secret of his technique it will be difficult to place a definite estimate of value upon the Wollf method. It seems, however,

to be a treatment so laborious and tedious as to be wholly unsuited for use by the physician himself.

"Electricity" has been vaguely recommended for writer's cramp by various authors, but in actual practice has been nearly always wrongly employed, even by distinguished neurologists, and especially by those who have utilized old forms of apparatus and coarse faradic currents. No other medical agent suffers so much from bad methods as does electricity, but when employed skilfully in the manner which I shall here direct it is deserving of more confidence than any other plan of treating the above affections. This conclusion is based upon personal experience.

Commence treatment by instructions as to diet, nutrition, personal habits, muscular exercise of the arm, and hygiene; and prescribe remedies to relieve anæmia, neurasthenia, or any existing condition which keeps the general health below par. The exercises for the arm should be of a general nature to improve the strength of large groups of muscles and should not involve an extra tax upon the small muscles whose co-ordination is affected.

The varieties of conditions which progressive stages present require different local treatment, and all local treatment must be engrafted upon constitutional measures.

Early Stage of Easy Fatigue with Disordered Sensations.—Current: The general nutritional properties of static electricity may be employed by either positive electrification, or breeze, and mild sparks, for constitutional effects. The local treatment of the arm is accomplished with either a rapid interrupted small Leyden-jar current, or by a rapidly interrupted high-tension induction-coil current from the author's improved apparatus.

Technique: Place a flat, sponge-covered electrode of about twelve square inches surface on the upper spine over the roots of the brachial plexus. Connect it with the positive pole. Press the flat palm upon a similar negative electrode. Pass a fine, nutritional, rapidly interrupted high-potential current for

three minutes. Increase dose from zero to a strength just causing a pleasant general thrill along the arm without producing muscular contractions or fatigue.

Then shift the positive electrode to the middle flexor surface of the forearm. Let the weight of the arm rest upon it with the extensor surface uppermost. Take an ordinary hand sponge-covered electrode, moisten it in warm water, and lubricate with soap. With the same current as before, just strong enough to act decidedly upon motor points without fatigue to the muscles, pass the hand electrode with rapid movements up, down, and over the entire extensor surface of the arm and hand, producing gentle passive exercise of each group of muscles by action upon the motor points, and general nutritional effects throughout.

Change the positive electrode to the posterior forearm and repeat the same effects upon the flexor surface. About five minutes to each surface is sufficient. By study of the muscular action and reaction under the electrical stimulus determine the muscles most needing treatment, and exercise them particularly.

Repeat *séances* daily for about two weeks, and thereafter as may be required. When done correctly with the proper current and dose the result is increased lightness, comfort, buoyancy, elasticity, speed, and endurance. These good effects begin with the first sitting and progress in permanency. If improperly done, the arm aches and is tired after treatment.

Later Stage of Distress in Arm, Pains, Sense of Heaviness, Quick Fatigue and Weakness.—Repeat the same treatment as in the preceding stage. At the close of each sitting change from the rapidly interrupted current to slow interruptions of about seventy per minute, increase the strength sufficiently, and for a few minutes cause slow, painless but strong contractions of all the muscles between the shoulder and wrist, omitting the hand.

In this and all later stages of writer's cramp there are usu-

ally two special conditions demanding attention. Make deep pressure with the thumb upon the flexor and extensor sides of the forearm over nerve trunks and motor points to detect areas of *local tenderness.*

Treat each spot found by long fine coil, or Leyden-jar sedation, until the tenderness is relieved. Press the positive pole over the tender point, place the negative opposite, and pass the current directly through the tissues until sedation is complete. It will require perhaps three or five minutes at each sitting until the condition is permanently overcome. The current should be interrupted with the maximum of rapidity, and the strength gradually increased to full tolerance, and at the close of the application reduced very slowly to zero before removing the electrode. The electrodes are held in one position during the application.

The second condition is *deficient synovial lubrication* of the tendons of the wrist and hand. Some distress in the parts may also be present, but this is relieved and synovial lubrication at the same time restored by the same tonic sedation applied to the upper points of tenderness. After the stabile application is, made the negative electrode should be rapidly whipped over the surface a few times for quick circulatory and muscular effects to relieve any sense of heaviness caused by the preceding method.

In cases which have not progressed beyond these stages the relief is marked, the arm "feels natural," abnormal symptoms are speedily removed, and the usual amount of work can be done with comfort after from two to four weeks' treatment.

The hand may not become so good as before it failed at all, but it is restored to practical satisfaction, and if it relapses in time under continuous use it should be treated again. The operator should also avoid overtaxing it and always work within his speed limit. In this way the hand can be kept in working condition for years. The best prophylaxis is moderation in regular working speed.

Paralytic Stage.—When loss of power becomes the most pronounced symptom, and speed and strength no longer respond to the operator's will, the method of treatment may commence with the plan above described if indications are present, but treatment must also include attention to the paralysis.

The electrical reactions of the muscles will be found to be slower than those of health. They contract and relax gradually instead of quickly. Restoration involves the long, slow treatment of chronic paralysis, and is altogether a different matter from the treatment of earlier stages of chronic fatigues only.

The muscles of the arm and hand may be stimulated by either the galvanic, faradic, or static currents if either is properly applied with proper apparatus.

Home treatment with the cheap type of faradic battery is usually injurious, and never curative.

The nutritional effects of the constant galvanic current, positive electrode on the cervical spine, negative water-bath electrode covering the entire hand, with several slow reversals during a fifteen-minute *séance*, may be employed as an intercurrent treatment. The dose should be about ten to fifteen milliamperes.

When an interrupted high-potential induction current, or an interrupted galvanic current, is employed to exercise the muscles by slow contractions, the rate should not be greater than about seventy periods per minute, and the current strength and duration of sitting should be short of causing pain, fatigue, or distress of any kind, during or after treatment. My own special method of treating this stage of writer's cramp is as follows:

Seat the patient on the static platform with the sleeve of the affected arm rolled up. Immerse the hand in a deep jar water-bath connected with one pole of the static machine. If the season of the year or activity of the machine makes the current exceed tolerance with positive electrification the jar should be connected with the negative pole, which gives a milder contraction. The positive is preferable, however, and by slowing

down the machine until the muscles develop sufficient tolerance to accept more powerful contractions the dose may be regulated to the proper degree of comfort.

Ground the opposite pole. Also ground the brass ball electrode and by regularly interrupting the positive charge by sparks between the prime conductor and the electrode cause slow and restorative contraction of all the muscles of the arm.

The interruptions by the spark should be about sixty per minute, with numerous periods of rest during a ten-minute application, so that the after-effect is never fatigue but is always an ever-increasing feeling of buoyancy and strength.

The electrode must be judiciously manipulated by the hand of the operator and not fixed on a standard. Beginning with mild sparks the current may be gradually increased by making the machine revolve faster.

A reasonable time within which to expect a fairly established improvement is three months, but frequency of treatment will have a good deal to do with the matter. It will also make a great difference whether or not the patient is able to rest during the period of treatment. In many cases the occupation which affords the only means of living cannot be stopped and this interferes seriously with the rapidity of improvement.

Coincident with the local treatment by this valuable method is also the general constitutional benefit which is imparted at the same time by applying a few static sparks to the spine and general muscle surface of the body before closing the sitting.

The Stages of Cramp and Spasm, and also Total Disability.—If these are mild, occasional, and occur only after excessive work has produced extreme fatigue, they will disappear during the treatment of the general vasomotor and trophic disturbances or the paralysis, by the methods described above.

If tonic cramp seizes the wrist or finger muscles almost at the outset of the day's work the prospect of cure is less hopeful.

If the cramp follows the first attempt to use the pen or telegrapher's key, and does not relax in a moment but speedily

grows worse so as to totally prevent the use of the hand, the prognosis is unfavorable, although partial improvement may be obtained.

In these cases the arm is often affected with pains, numbness, or other sensations which impair sleep and render the patient uncomfortable even when writing or telegraphing has been suspended. These symptoms can be relieved and the arm restored to normal comfort very readily by high-tension-current tonic sedation, and if the person ceases the occupation which fatigues the arm a course of three months' careful treatment will also greatly improve the powers of co-ordination.

It is, however, difficult to "cure" the total disability stage of writer's cramp so that regular work can be resumed and maintained. I have never been able to conduct a case in this late stage to a satisfactory conclusion, possibly for the reason that such patients have not persisted in treatment. It is noticeable that the victims of this affection desire to be "cured" more rapidly and with less trouble than persons who are afflicted with some other chronic diseases, and they become more impatient perhaps because it is so universally understood that they are incurable. I have attempted a variety of sedative and antispasmodic methods of electrical treatment for severe and persistent cramp, but as none have proved curative it is useless to describe them here.

The best results appear to be obtained by simply continuing for a much longer period the methods that afford relief in the earlier stages. In treating writer's cramp the physician must be competent to adapt the electrical application to each case, and no two cases are exactly alike. An expert knowledge of the disease is fully as important as a knowledge of treatment.

Non-use or modified use of the affected arm is of course desirable during treatment, but in most of the cases treated by me the patient was obliged to keep at work, often, however, substituting the left hand for the right.

When the left arm has been mildly affected after total loss

of grip of the right hand it has rapidly regained full power under treatment, even when no special relief from daily work was obtained. The treatment of the left arm under these circumstances relates almost invariably to the early stage of the disease, and consequently the prognosis is good

As a matter of fact there would be no such thing as actual writer's cramp if all persons were properly treated in the acute stage, for the advanced symptoms could be warded off indefinitely.

Of the efficiency of a single sedative-tonic application of a rapidly interrupted, high-potential current to remove the immediate results of muscular fatigue, I have had many evidences in clinical experience.

An Acute Example.—The typewriter who is copying this MS. for me began to work at her most rapid speed for seven hours a day after being without practice on the machine for nearly three years.

At the end of the third day's work her shoulders were pretty lame and her right hand ached intensely through the palm, from the strain upon the muscles caused by spacing entirely with this hand. To quote her own words, she felt "as if every word she wrote would be the last she would be able to do," and her hand was, in fact, completely worn out.

When a condition of this kind is aggravated by day after day of overtax at high-pressure work it results in the condition known as writer's cramp. This lesion is not the effect of slow and deliberate work, however long such work may be continued, and almost every operator whose arm gives him trouble can point to the time when some extraordinary task proved to be the last straw which broke him down.

An application of positive static breeze was made to the aching shoulders of the young lady I am referring to, and the local application to the muscles of the forearm and hand occupied about five minutes' time. The relief experienced was absolute, and the hand has never bothered her again. The single application took away the sense of fatigue, the ache, pain, and distress, and during the thirty days of hard work which followed she had no further need to repeat the treatment.

It is certain that nothing in the way of rest, lotions, massage,

or any other forms of procedure can take an exhausted group of muscles in hand and transform them into a state of natural comfort and functional activity so successfully as the method described above.

Experience confirms the conclusion that the methods pursued by me in the treatment of these cases will restore almost all cases of writer's cramp in the early stages.

In the middle period of the affection the arm can be improved and thereafter kept in fair working condition by repeating treatment from time to time as the need arises. Attention to the arm for a few weeks each year would defer paralysis indefinitely.

It is not necessary to consider the prospects of a radical cure, for if a means of recuperation is available whenever the arm begins again to fail, it will enable the operator who does not again overtax his arm imprudently to use it so long as he pursues the vocation. In the advanced stages of actual and severe cramp the patient must usually change his vocation and be satisfied with the relief of distressing symptoms, if any such exist.

As my investigations indicate that about thirty thousand persons in this country suffer from some form of occupation neurosis at the present date, in the various stages from preliminary symptoms to complete loss of power, the importance of a means of relief is obvious. As no means of cure of the final stage has yet been discovered, it is plain that all persons whose income depends upon an occupation producing writer's cramp should heed the first signs of fatigue and unusual sensations and preserve their arm by proper treatment when "one stitch in time saves nine."

CHAPTER XLVIII.

CHRONIC FUNCTIONAL NERVOUS DISEASES.

Principles of treatment with static electricity. Temporary functional nervous derangements. Methods of treatment. Acute chorea of children. Clinical methods of treatment. Results. Treatment of limited chorea. Treatment of chronic chorea in adults. Indications defined. A consideration of different methods.

THE general principle of "treating the patient rather than the disease" should be followed in these cases, and efforts are to be made in the direction of "aiding nature to restore the sound state."

Depend upon general positive electrification for its sedative-tonic effect; upon the breeze, spray, and mild spark to relieve local symptoms, especially pains, aches, and muscular debility; and adjust the methods employed to the individual needs of the patient.

No rule can be laid down in advance. Daily repetitions are always advisable at first if they can be arranged. It is fatal to good results to allow too long an interval between treatments, for the benefit of the first will then be often entirely dissipated before the second is given.

It is the aim in all static electro-therapeutics to accumulate benefit upon benefit instead of wasting repeated sittings by delays between them.

Temporary Functional Nervous Derangements.—Many of these will obtain speedy relief from some form of static application adapted to the symptomatic manifestations, without reference to the apparent cause. The basis of treatment in

this class of cases is the function-regulating, sedative-tonic action of positive polar-general electrification, upon which must be engrafted such local uses of the breeze, spray, or spark as may be required to meet the indications.

In all these cases we must treat the general health of the patient, and it is impossible to direct special methods in advance of seeing the case. References to diseased conditions by the terms of classical nosology are not very helpful. If the operator is informed as to the effects his different methods will produce and knows how to administer them with judicious dose-regulation, he will be fully prepared with static electricity to meet and relieve a great many manifestations of the functional neuroses.

Acute Chorea of Children.—Static electricity treats the patient by way of aiding nature to restore the nervous equilibrium.

Administer simple positive electrification for fifteen minutes at first. As soon as the child is free from alarm and will accept all the operator wishes to do, shorten the general treatment by one-half and devote the second part of the sitting to a concentrated positive breeze over the entire head and spine, with particular impression upon the centres of the medulla and cerebellum.

To this may be added shortly, and later substituted for it, an application of mild positive sparks to the cervical and lumbar spine—and ovarian region in front if the patient is a girl. Do not agitate the already overactive muscles by sparking the arms.

Repeat daily until the nervous system remains tranquillized for a longer interval, and then every second or third day as may be indicated.

The average results of medical treatment of chorea will be made more certain, more quickly attained by probably one-half, with an early and immense relief to the patient's nerve tension, and decided improvement in general health, when static elec-

tricity is employed in conjunction with the use of indicated mild remedies.

It is efficient in some cases alone, and when rheumatism complicates the chorea it is more than ever indicated, and should be employed in every case with an intelligent adaptation of the method to the state of the patient.

If there is marked brain disturbance the best primary application is negative electrification with positive head breeze. The habit of pushing Fowler's solution of arsenic to the border line of poisoning the patient for the sake of combating chorea is an extremely poor one from the standpoint of rational therapeutics, and is left without excuse when the resources of static electricity are employed.

In the very small proportion of cases in which it fails to make a decided impression upon the spasmodic symptom, its influence for good upon the nutritive processes, pelvic functions, and upon the cerebro-spinal nervous system in general indicates its aid as one of the best and most grateful helps the patient can receive.

That there are some causes at work in the production of exceptional cases of chorea which render them practically incurable is self-evident, and it is not necessary to explain that electricity will not cure all cases of chorea.

In persistent, localized chorea of a limited part, the nervous state is usually so below par that static electricity may well be employed even if no hopeful prognosis for relief of the chorea can be given.

It will improve the strength, composure, confidence, and spirits of the child, and in this way, if in no other, will be beneficial to the extent of perhaps one-half the value of a radical cure.

In partial choreic affections from chronic spinal disease the spasmodic movements cannot be made normal, but the patient can nevertheless be given so much comfort and relief from various symptoms—pain, irritability, morbid mental states, etc.

—together with added strength to the arm or part affected, as to express decided satisfaction even when the physician will note that the so-called chorea is nearly as bad as ever. It may be, but the patient is better, and is often inexpressibly grateful to static electricity for the measure of relief afforded by it.

Chronic Chorea in Adults.—Static electricity is by no means without practical value in cases of chronic and incurable chorea in adults, nor is it difficult to say in advance what benefits the patient may expect.

The indications for various forms of electricity are by no means mere guesswork, but are accurately outlined in the ascertained facts of electro-physiology, and quickly attain even more accuracy than do the indications for most drugs under the instruction of educated experience.

If the patient is muscular, strong, well nourished, with good appetite and digestion, and practically without symptomatic disturbances except the spasmodic movements, do not expect any material benefit from static electricity. I do not undertake such a case except at the patient's urgent request, and with the understanding that the treatment is purely experimental and little or no results are to be expected. This class of cases is in the minority.

If the patient is at the antipodes of the electro-positive state of general health, is negative, anæmic, neurasthenic, the whole muscular and nervous system debilitated, with broken sleep, headaches, spinal and muscular pains, and other symptoms which are much more frequently met in these cases than otherwise, static electricity will do good in direct proportion to the degree of the negative state. For a full explanation of the *rationale* of the effects of static electricity in benefiting these patients, the reader who has been referring them to chance is referred to the chapter in this book upon the physiological action of static currents.

On September 9th, 1893, I reported the following case which exemplifies the above remarks:

Miss ——, chronic chorea of forty-four years' duration. This interesting case had its origin in a fright when the patient was six years of age. She is now 50, single. Weight, 105 pounds; extremely nervous, head and right arm affected; head would play a tattoo on the pillow half the night before she could compose it for sleep. Arm nearly powerless. No appetite, dreaded the observation of strangers, and lived a secluded life. Had constant pains in occipital, cervical, and lumbar regions.

After one month, during which she had only ten treatments, she reports: "Owing to illness in the household, I have had to assume duties much beyond my strength, so that I have been unable to do justice to my own health. I have, however, gained three pounds, sleep composedly, am hungry for every meal, go out alone freely, do not mind the gaze of strangers, am less nervous, can use my arm for many little services, can stoop and pick up an object from the floor, a thing I never did, in my recollection, until now.

"I have had no pain in my head and back since the second week of treatment, and the constant sense of nerve strain which I formerly had is entirely gone, so that I have more comfortable rest than at any previous period of my life."

During the three and a half years which have since elapsed I have kept track of this case. She has been under an unremitting strain of domestic cares, and has been and still is in great need of much further treatment. Once in a while she has come to me for quick relief from some temporary symptom which she has learned from experience that a single static administration will abolish, but she is not so circumstanced that she is able to attend to her own health in a proper manner. She, however, has stated to me over and over again that she has never lost the original improvement, that but for the benefits derived from the static applications she could not have endured the subsequent tax upon her, that the distressing pain in the cervical spine from which she suffered for many years has never returned except for brief intervals when she was extremely fatigued, and she often expresses her gratitude for her general increase of comfort and strength.

Another phase of chorea in its chronic and practically incurable form is illustrated in the case of J. D.:

J. D——, October 5th, 1896, aged 35, porter by occupation. Chorea began in early childhood following scarlet fever, affects both upper extremities and head. Is a hardy, muscular man of medium weight, and when sitting with his hands grasped together, controls the movements to rest his arms by pressing them between his knees.

Owing to the fact that practically no improvement in his nutrition, digestion, sleep, and muscular strength was needed, and that he had no pain or other symptoms except the spasmodic movements of the head and arms, he was told that his condition was not favorable for treatment. He, however, expressed an earnest wish to "try electricity," and he was accordingly given eight administrations between October 5th and October 23d. No change in the state of the chorea took place, and although the patient desired to continue the treatment for at least three months in order, as he said, to thoroughly satisfy himself, I considered the indications very clear and declined further treatment.

In choreic movements associated with spastic paralysis of an arm, with atrophy and tonic contraction of the hand and wrist muscles, the prognosis from electrical treatment can only refer to improving the general health and local nutrition and strength. The chief symptoms will remain about the same except so far as they are ameliorated by the processes of nature. The treatment of such a case was begun September 9th, 1896.

E. R——, aged 14½, right foot, leg, hand, and arm affected, also neck and head in a less degree; the muscles of speech are affected, but he can talk so as to be understood. Duration of disease, four years. The boy was anæmic, exceedingly nervous, and startled by almost everything going on around him. He was fairly strong and of fair size for his years. He was regarded as incurable, and his mother who brought him for treatment was so informed; but as she expressed a wish to do everything that could possibly be done for her child and leave nothing untried that might be of benefit, treatment was undertaken with no promise as to the results.

Between September 16th and December 4th he received thirty-two applications by various methods as they were in turn indicated.

At the third visit he reported that he felt improved, less nervous, slept better, was not frightened so easily, and that he had

picked up a lead pencil from the floor with his paralyzed hand, which he had previously not been able to do.

While an observer could detect no anatomical change in the condition of the wasted and spastic muscles or the contracture of the knee-joint, yet the boy persistently stated that the treatment was doing him good, and his mother said that he was so eager to come that nothing would induce him to miss a single treatment. He had, however, an acute attack of tonsillitis and did not attend for two weeks.

On November 16th and 23d entries were made in my case record as follows: "Has grown steadily stronger, is less nervous, has a good, hearty color, and although arm and leg are but slightly improved, his general state of health is remarkably improved; he has grown into a stout, rugged boy, and feels greatly benefited."

The manner in which this boy began to grow and change in spirits while he was treated with static electricity excited frequent comment among physicians and others who observed the case.

Case reported by Dr. F. A. Kraft, Milwaukee, Wis.:

Chorea.—A girl, 13 years of age, presented herself at the office with a very marked case of chorea; her speech was an incoherent mumble. I examined her closely, but did not find any cause that could have produced her condition. Gave remedies like arsenic, gelsemium, etc., but with no results. The second week I applied the static current, particularly upon the spinal region. An astonishing effect was also derived from the static head breeze, which seemed to have a direct antidoting effect against the disease. Immediately after the treatment a desire for sleep manifested itself, and after having enjoyed this blessing of nature for a few hours the patient awoke refreshed. After eleven treatments she was discharged.

Her older sister had chorea two years ago and was treated for twelve months by other methods.

Chorea has been successfully treated by different physicians by different methods of employing static electricity. Bishop has employed the static cage with much satisfaction and cites the following case:

A young lady who was sent home from a seminary in consequence of a severe chorea minor, complicating chlorosis. She

was placed in the static cage and given the shower bath ten minutes.

During this time she was made to inhale deeply and regularly the electrified atmosphere which surrounded her. The poles were then approximated and the oscillating current, as strong as she could comfortably stand, was given for ten minutes. At the end of the treatment she would invariably come out of the cage with rosy cheeks. At the end of three weeks her menstrual function was re-established, the chorea was gone, the chlorosis had disappeared, and she went away feeling well and happy. This case was treated daily.

The static cage, as described by me elsewhere, is simply an expansion of the static breeze, and Brower reports his experience with the ordinary form of breeze in the following language:

The patient is placed upon the insulating platform connected with the positive pole. The head-breeze electrode is connected with the opposite pole. The total treatment consists of ten minutes' simple positive electrification with five minutes' head breeze, after which the patient rests in the reception-room for about ten minutes. Treatments are repeated if possible every day for the first week, then three times for the second week, and two treatments thereafter until the case is relieved.

All of the eighty-eight treated (by Brower) were also placed under the best possible hygienic conditions. Eighty-three of the cases had a duration of disease averaging from twelve to eighteen weeks and had resisted the treatment of the family physician, and were subjected to static electricity because the physician, or parents, or both were discouraged with the effects of other remedies.

When necessary school was stopped, an hour of rest required in a darkened room at midday, the diet carefully regulated, and elimination by the bowels, skin, and kidneys maintained at a proper standard.

Arsenic in some form and in varying doses was administered to all. In the most rebellious cases it was pushed to the limit. Blaud's pills were given in anæmia. If the patient was a female and puberty was delayed, cimicifuga was administered for its tonic properties on the uterus. If the patient had a rheumatic history, sodium salicylate, or more recently salophen, was made a part of the treatment.

If the sleep was insufficient, bromide of sodium, with or without chloral, was administered at bed-time.

Fifty-three of the cases were females, thirty-five males. Ages ranged from six years to thirty years.

Five of the cases only were acute and had continued less than one month.

The immediate effect of the treatment on these patients was often magical. Just as soon as they became completely charged on the platform, the violent contortions would stop and the patients remain quiet as long as the treatment was continued.

Forty-five per cent of all the cases treated were relieved in about six weeks. The more chronic the case the longer the treatment was necessary. I have just completed the successful treatment of a case in which the disease had continued uninfluenced by all other treatment for two years. The static treatment was five and one-half months.

It is, however, superfluous to attempt to add much to the classical reports upon the treatment of chorea by static electricity which are contained in the latter part of this book. Every physician should study them in detail and profit by the sound remarks which accompany them. The modern machine supplies something of the deficiencies which surrounded the methods employed half a century ago, and we now expect not only better results but very much greater help in improving the constitutional state of the patient than was possible when Leyden-jar discharges were the chief means employed.

CHAPTER XLIX.

MORBID MENTAL STATES.

The physiological action of static electricity. Effects of electricity in regulating the functions of the mind and body. Clinical cases, with the results of treatment. Auxiliary galvanic methods.

Some degree of physical ill-health causes or complicates the departure of the mind from normal action. In either case a two-edged sword is at work cutting both ways, and the mental and physical states grow worse together.

The majority of recent cases of impaired functionation of the mind have either sleeplessness or active brain excitement, or mental torpor, or morbid motor activity, or the reverse, as part of their symptoms at some time.

Almost every state of physical disease affects the mind secondarily; and as an ounce of prevention is worth a pound of cure, it becomes forcibly impressed upon the mind of every one who studies insanity in its most common forms that some time before the door of an asylum opens to receive the patient there should be an earlier effort made to nourish the body, to restore its nervous energy, to regulate its functions, to direct thoughts into healthy channels, to exercise muscles and subordinate centres so as to provide physiological and safe outlets for hyperexcitability, increase self-control, sleep, composure, and normal digestion, and occupy the mind in a happier way.

The physical changes which accompany certain forms of insanity are very marked. In melancholia the skin often becomes rough, dry, and hard. The hair changes and becomes coarse and wiry in many cases. The tongue is seen to be milky and

tremulous, the hands disclose a tremor and sluggish capillary circulation.

If these external appearances are associated with similar perversions of nutrition in the brain substance the mental state is easily accounted for.

It is not, however, of mental alienation which has conducted its victim to an asylum that I wish chiefly to speak, but of the treatment of states of the mind which come to the office of the general practitioner and which are yet far from the portals of insanity, or if bound to that ultimate destination have made so little progress that the danger is not suspected by either themselves or friends.

When a person is unable to think clearly or continuously upon business or domestic matters; to fix the attention; to control the memory; to maintain cheeriness of spirits; finds that the faculties are either dull and sluggish on the one hand, or restless and overactive on the other, this state of things is almost certain to be removed during the application of some suitable form of static electricity. In exerting its influence in regulating the functions of mind and body into normal methods of action, its beneficial effects are accomplished without any of the drawbacks attendant upon the immoderate use of hypnotics, sedatives, stimulants, and motor depressants.

When the disturbing mental symptoms are dependent upon some physical disease of a curable nature, and more especially if they are the result of worry, overwork, excitement, grief, shock or alarm, or long-continued loss of sleep, the beneficial action of static electricity is pronounced.

There is nothing equal to it to clear up the mind, brush away the cobwebs, or soothe it, re-invigorate it, and re-establish its normal workings when these are impaired by purely functional derangements.

If in states of great neurasthenia the memory is so weakened as to be almost lost, and the mind is so debilitated that even the mere thought of performing a simple act has set the patient

in a tremor and caused her to fear that she was losing her reason, I have seen the patient in four weeks' treatment with positive electrification, nourishing food, and iron, leave my house with a sturdiness of mental and physical vigor she had been a stranger to for years.

To give minute consideration to every variety of morbid mental state and discuss it in detail would require a book by itself; but to those who are especially interested in sanatorium or asylum practice in the treatment of the more advanced cases of this kind it is sufficient to say that a study of the physiological action of static electricity will acquaint them with a remedy of great value, and if they will but learn how to employ it, it will lighten their cares, reduce their difficulties of medical prescribing, win the approval and appreciation of their patients, and produce results which in no case will be injurious, in a few cases will be brilliant, and in almost every case will benefit the patient in some way.

The treatment of these cases cannot always be carried out upon indicated lines. Whims must sometimes be humored, and tact, discretion, and personal management will be necessary to induce some of the patients to accept the form of treatment which will do them the most good; but all patients become instinctively aware of whether the operator is skilled or bungling, and they will usually act accordingly. The more competent the operator in the management of technique the more certain it is that he will achieve the best results with the least difficulty.

The following cases and remarks were reported by Dr. W. F. Robinson*:

Case I.—Julia O——, aged 19, servant. Family history good except her father, who was a drinking man. She has two sisters who are apparently all right. Has a mother and an uncle, both in good health. About two years ago her father suddenly disappeared, and some months afterward his body was recovered from the river, he having in all probability committed

* Journal of Electro-Therapeutics, July, 1894.

suicide. The disappearance of her father was a great shock to the girl, and since that event her whole character changed. From being bright and cheerful she became sad and despondent, and instead of getting over it as time went on she seemed to grow worse.

When she was brought to me a little less than two years after her father's death, her condition was as follows: She is a little below the medium height and well nourished. She feels very sad and despondent, weeps a great deal; has no hope of ever being any better, and had to be almost dragged to my office by main force by her friends.

Fortunately they were very much alarmed at her condition, and fearing that she was really going crazy, they insisted upon her seeking medical advice. She has a great deal of headache, and feels tired and unequal to her work. She worries constantly about her mother, who is notwithstanding in very good health. She also torments herself with the idea that her own work is not well done, which is very far from the case, since she is a very good worker. She often speaks of the river, saying that she longs to plunge into it and rejoin her poor dead father. She sleeps wretchedly, and frequently has attacks of weeping at night. Finally, all the above-mentioned symptoms had been growing steadily worse for some time previous to the date of her consulting me.

This might appear to be a simple case of hysteria or nervousness, and yet to the experienced observer there were very evident signs of approaching insanity.

The peculiar ideas which she entertained regarding her mother's illness and her own work, although hardly to be called delusions as yet, would not be long in developing into them. If this case had been allowed to go on it would in all probability have developed into outspoken melancholia with suicidal ideas. Indeed, the act of suicide might have been suddenly accomplished before her friends realized what her actual condition was.

Treatment: Small doses of the compound syrup of the hypophosphites were ordered, and she received the simple static charge for ten minutes three times a week. All her symptoms began to improve from the very first. First of all she began to sleep better—always a good augury for the results of the treatment. Then the crying spells were less frequent and shorter in duration. After two weeks of treatment she would occasionally laugh again. She received altogether seventeen treatments extending over a period of six weeks, at the end of which

time she was discharged as cured. The morbid ideas, along with the attacks of weeping, had disappeared. The appetite and sleep returned, and she felt strong and ready to work.

While working she would laugh and sing in her old way, and her friends declared that she seemed to be just as she was before her father died.

This case is not by any means an isolated one, but, on the contrary, it represents a class of cases frequently to be met with. In the transition age of puberty or adolescence, when the mind is filled with new thoughts and emotions, it is especially sensitive to disturbing influences. The disturbing influence was supplied in this case by the sudden disappearance of her father. This acting on the girl's sensitive and high-strung nervous organization was sufficient to throw it off its balance.

The following case should not perhaps be cited here, since when brought to the writer's notice it was no longer incipient but outspoken insanity, of the form known as melancholia. Though the disease was well defined, it was still in an early stage, and what is still more important, it was possible to treat it at home with careful watching. Cases as serious as this one are kept at home with a good deal of risk, owing to the liability of suicide.

Case II.—Miss M——, aged 38. Family history very bad. Her father and mother were own cousins as well as her paternal grandfather and grandmother. Her father was insane to a mild degree, having well-marked delusions of persecution as well as other symptoms. His uncle had had softening of the brain when an old man. The patient's mother had a sister and a niece who were insane. The patient was of a sensitive disposition, but had enjoyed fair general health most of her life. She had suffered at one time from lateral curvature of the spine, from which she entirely recovered under appropriate treatment.

More than a year before the patient was brought to me her father was taken with the *grippe*, and as he recovered from this malady he developed well-marked symptoms of insanity. Although his bodily strength had returned he refused absolutely to go out. He would walk around the house, looking first out of one window and then out of another, and declaring the people in the street were gathering to attack him. At times he would become profane and violent.

It can readily be imagined what effect this would have upon the mind of the daughter. She soon began to be nervous and sleepless, and would not go out herself. She got so that she could not keep still even to eat her meals, but would stand or

kneel at table. When brought to me her condition was as follows:

Patient was stout and healthy-looking. Appetite and digestion fair. Her mental condition was one of most demonstrative grief. Could not keep still, but walked very rapidly up and down all the time, wringing her hands or pulling down her hair. She could hardly contain herself; groaned and uttered such exclamations as: "I cannot endure it," "I will not have it so," "Why did I allow myself to get into such a condition; it is too late and my life is ruined." She was unable to fix her mind upon anything—either to sew, read, or play games. Her sleep was very poor.

Treatment: A good generous diet was ordered for her, and she was made to go out every day for a walk. The static charge was given daily—for five minutes at first, and then for ten minutes. The improvement soon began to manifest itself in better rest. After walking in the morning she was more quiet and like herself. Gradually she became less nervous and did not talk so much about herself.

She received twenty-eight static charges in as many days, and then it seemed very desirable for several reasons that she should be taken into the country, since quiet and fresh air are both very valuable adjuncts in the treatment of this disease. She was therefore taken to the house of a relative who lived on a farm, where she was kept almost constantly in the open air. The result was that the improvement continued without interruption, and three months later she was brought into my office in a condition of perfect health both bodily and mentally. This made the time four months in all, from the time I first saw her to the date of recovery.

This case is also cited for the purpose of showing what can be done outside of an asylum. In view of the terrible family history which this patient presented and the aggravating character of all the circumstances, the writer could not but feel a certain satisfaction at the result obtained.

The last case cited will be that of a patient suffering from climacteric insanity, a common form of disease seen in our country to-day.

This form does not necessarily come on just at the menopause, but may occur shortly before the cessation of the menses or as late as five or six years after this event.

These cases generally yield to the electric treatment, but on the other hand they are quite apt to suffer relapses.

When a case of this kind has been sent home cured, it is

always desirable to warn the family of this fact in order that they take special precautions to guard against a return of the malady.

CASE III.—Mrs. T——, aged 50, has a husband and one son, both of them devoted to her. Always enjoyed fair health up to this attack. The courses ceased about four years ago. About a month before the writer saw her, she began to worry about her clothes. She could get nothing to suit her. When a new dress came home it pleased her so little that it went back to be altered, but when it returned it would still be unsatisfactory, and perhaps go back a second time. Her character also underwent a change, and she became abnormally depressed and nervous. She seemed to lose all interest in everything.

When brought to the writer for advice she presented the following condition: A sad-faced lady, well filled out without being fat. Very listless and passive in her movements and general demeanor. Appetite and bowels fair. Sleep very poor. Complains of constant headache, also pains in various parts of the body. She was ordered a preparation of phosphorus, and the static charge was given daily for five minutes. The electric treatment is generally very efficacious in producing sleep, but this patient was so insistent in demanding some hypnotic that a small powder (five grains) of sulfonal was given her every night, more for its moral effect than anything else.

Under these conditions she slept very well with the exception of one or two nights.

This patient was most obstinate in her determination to look on the dark side of the matter, and never tired of repeating that she was never going to get well and be restored to her family, and whatever encouragement we tried to give her she said we did as a matter of course, and that we knew perfectly well that her case was hopeless.

In spite of this determined mental attitude of the patient, her improvement could almost be seen from day to day. She was made to walk or ride out every day, although she frequently demurred at this. When the weather was fine she was sent with an attendant or friend to take a long ride on electric cars or the boats.

During the first week of the treatment she would have almost every day peculiar attacks, in which she would "go all to pieces" as she expressed it. She would lose all control of herself and walk up and down the room exclaiming, "I cannot stand it another minute," "I am going crazy," etc. The actual attacks

grew less and less frequent, and finally disappeared altogether. At first she declared she could not touch sewing of any kind, although naturally very skilful with her needle. After the first week, however, she began again little by little, and by the end of the second week she would spend an hour or two every day in doing fancy work.

She was under treatment exactly one month, at the end of which time she was able to return to her family.

The histories of these three cases will serve to show the method of using electricity and the results obtained.

My experience in the use of this agent leads me to conclude:

First, that it has a powerful action on mental affections in their early stages.

Second, that many cases of insanity, or, to speak more correctly, of mental disturbance leading to insanity, may, if recognized in time, be treated and cured by this agent, and the outbreak of the fully developed disease thereby avoided.

Dr. W. C. Allen, of Cranford, N. J., reports the following: From a personal use of the static electricity, as well as the other forms, for about two years continuously, I must unhesitatingly say that no other form of electrical treatment will work such marked and lasting benefit in all forms of depression of the general and especially of the nervous system as this one form; and this is the case whether the depression is of the bodily or mental spheres; a single treatment will quiet an overexcited nervous system, and tone up an exhausted body in a manner which cannot be understood except by actual observation. I have personally cured, not relieved for a time, but cured nervous sick-headaches, which had been making the patient miserable for days, by a twenty-minute treatment, and have repeatedly had the patient go to sleep while taking treatment, and not awake until the machine was stopped, and when they did awake they were entirely free from headache, feeling, as they expressed it, much rested, and here I desire to state that I have found the most soothing effect is gained by the static breeze.

In the various forms of mental depression, such as mild mel-

ancholia, I have found it very beneficial, and I know of nothing, either in medicine or massage, or any of the other forms of electricity, which will compare to the static in the treatment of this trouble; and the benefit is not temporary, as some have stated. The patient seems to have more resisting power, and, as one patient said, "things do not worry me as they did formerly because I don't let them."

Case I.—Mrs. A——, married, and the mother of several children, two living, became very much depressed because of the state of her husband's affairs, and finally she became so bad that it was necessary to watch her constantly to prevent her from doing herself harm, which she had several times tried. She knew that she was dying, and that she had better die as soon as possible so as to make the burden of the expense to the family less; medicine did no good, and she had doctors from both schools. Finally, when I saw her she was profoundly depressed, waiting to die, and when the treatment was mentioned she did not want to take it as it would add further expense to the family, etc. The first few times she came she was brought in a carriage, as she seemed too weak to walk, and the treatment was connection of the platform with the negative pole and the positive attached to the spray electrode, and the current directed over the temples, vertex, and the nape of the neck; her condition steadily improved; she took more interest in events about her, talked less about dying, and after two months' treatment—at first every day, and later every other day—she was practically all right, attending to her regular duties, no signs of the former depression, and, although the business affairs are no better now than they were when she was taken sick, she says, as I have already quoted, she does not let them affect her, and looks on the bright side of everything. Her entire treatment was electrical, as all medicine was stopped when she began taking electricity.

Report of cases treated by Wallace M. Knowlton, M.D., Assistant Physician Channing Hospital, Brookline, Mass.*

While static electricity has not supplanted faradism or galvanism in Channing Hospital it has proved a very valuable

* From recent personal letters from Dr. Knowlton.

agent in the treatment of certain forms of mental diseases depending on functional, nutritional, or circulatory disturbances, rather than organic changes.

The following is an abstract from the hospital records of a few cases treated by this method:

CASE I.—Simple melancholia. F. G——, a female, single, aged 55. Admitted May 16th, 1895. The illness began four weeks previously. She could not apply herself to any occupation, she was depressed and careless in her personal habits. She grew worse, and three months later it is recorded that "she often refuses food, she sleeps poorly, does nothing. She is in bed or on the lounge all the time." She is much distressed on account of her wickedness. The depression, with much mental and physical agitation, continued through the autumn and winter. April 3d, 1896, it is stated that her condition is much the same. Began treatment with static electricity—applying the spray or breeze to the head, and sparks to the spine ten minutes, this treatment to be repeated every second day.

May 21st: In the morning she is depressed and hopeless, but later in the day is quiet and will talk some on general subjects. She is sleeping and eating a little better. Treatment continued.

September 1st: Improvement began to be more noticeable last month and is now quite marked. She walks, drives, reads a little, and does some needlework.

October 1st: She is quite well, her weight has increased fifteen pounds. During the first twelve months she required a hypnotic often, a laxative occasionally, and at times a tonic to aid digestion. Since then static electricity has been the only therapeutic measure employed.

CASE II. Hypochondriacal melancholia. M. C——, female, widow, aged 62. Admitted September 18th, 1895. Since an attack of *la grippe* three years ago she has had frequent attacks of distress in the umbilical region which she terms faintness rather than pain.

This faintness is usually followed by several dejections, after which a state of nervous irritability comes on which lasts often for hours. Coincident with these attacks urticarial blotches appear which for a long time she thought were due to insects. The skin is dry and rough.

October 15th: She is at times quite melancholy, feeling that she will never be any better. Attacks of distress in the abdo-

men with the accompanying mental symptoms occur frequently.

December 1st: She is often wakeful and noisy after 3 A.M., and is always depressed in the morning, but quiet in the afternoon. Static electricity is prescribed in the form of spray applied to the head, and sparks over the stomach, abdomen, and spine, ten or twelve minutes every other day.

January 1st, 1896: Although she has some periods of depression attended with the usual abdominal disturbance, on the whole she is much more comfortable and at times hopeful. The distress in the bowels is always relieved by the application of sparks from the static machine, and she feels less nervous after treatment, after having a nap on returning to her room.

February 1st: She has improved very much since the last record. She is stronger physically, and is quite cheerful most of the time. The patient states that about a month after the treatment by electricity was begun she noticed that the skin, which had been dry and uncomfortable, was smoother and softer.

March 1st: She is entirely free from depression. She takes an ordinary diet with no unpleasant consequences.

CASE III.—Delusional melancholia. E. J——, female, married, aged 49. Admitted December 20th, 1895. This patient has suffered from indigestion for years. The past two years she has been growing nervous and hypochondriacal. Insomnia has been marked. She takes a very small amount of food, and has lost flesh, weighing one hundred and twenty-five pounds which is almost fifty pounds less than usual. The past two weeks she has been confined to the bed. On admission she is pale, thin, agitated, and depressed. She says she is going to die—that there is no help for her. She talks constantly about her severe suffering and has delusions in regard to her body and the food. She continued in much the same condition through the winter.

On March 5th, 1896, it is recorded that she sits up a few hours every day. She takes nearly all her food in liquid form. She says she will never be able to eat again; that her sufferings are "damnable" and she wishes she could die. Began treatment by static electricity, applying sparks ten minutes to the spine and over the stomach, liver, and abdomen, to be repeated three times a week.

April 15th: She takes more solid food. Her weight has increased twenty pounds, but she says she will have to sit and starve. She complains of various painful and disagreeable sensations from her head to her feet. Treatment continued.

July 1st: She has improved since last record. Although at times she is irritable and complaining, she is often cheerful and animated, and manifests an interest in her surroundings.

August 15th: She is much better in every way. She sleeps quite well. In this case and the preceding one hypnotics, pepsin, nux vomica, malt, and partially digested foods were employed for the first few months afterward. Electricity was the only therapeutic agent employed.

Case IV.—S. G——, female, married, aged 45. Admitted March 12th, 1896. She went to a sanatorium in June, 1895, on account of an attack of mental depression not amounting to insanity. Menstruation ceased two years previous. A few weeks before being transferred to this hospital she began to grow excited. The excitement and confusion of mind were increasing when admitted, and subacute mania developed and continued through the summer, improvement beginning in August. By the middle of October her mind was clear, but she was left in a somewhat depressed neurasthenic condition. Some of her former troubles reappeared, such as frequent backaches and headaches, sometimes accompanied by dizziness and nausea, and various other nervous manifestations, including inability to use the eyes for any length of time, and painful joints. The urine was normal. Salicylate of soda, then salol and phenacetin were prescribed with slight relief.

October 30th: A well-known specialist examined her eyes and reported that he found "nothing wrong except that she needs stronger glasses for reading than usual at her age, readily to be explained by a certain amount of neurasthenia."

December 1st: She is discouraged at times over her slow progress. Began treatment to-day by the electro-static bath, with the spray applied to the head and sparks to the spine, arms, and legs for ten or twelve minutes, to be repeated every second day.

January 1st, 1897: The headaches and pain in the back are relieved by the electricity and recur less frequently.

Sometimes after a treatment she says she feels "lighter and more like doing something." At the present writing (January 25th), the patient continues to improve and is in a more hopeful state of mind.

In a paper entitled "Some of the Important Aspects of the Therapeutics of the Nervous System," by Dr. J. J. Putnam (*Journal of Nervous and Mental Disease*, January, 1895), he

makes a statement that seems to be especially applicable to the cases like the one just described as well as to nervous diseases. He says: "As adjuncts to direct mental treatment, it is often useful to follow out systematic and prolonged courses of treatment of other sorts, and among these static electricity is especially worthy of mention. It may be of value in other ways, but it certainly is an aid in securing mental and muscular relaxation, and making the patient more susceptible to auto-suggestions of useful kinds."

One patient, a lady aged 63 who thought she saw a great many insects wherever she went, and for a year had had a delusion that they were in or on her skin, was treated every other day with the electro-static spray for three months without relief. Another patient, a lady aged 32 who had recently recovered from an attack of acute mania, but had some head- and backache, was treated by the electro-static spray to the head and spine, but would not have it repeated because it "stimulated her brain too much."

We have not used electricity in acute form of insanity. Benedikt reports the cure of a case of mania with grandiose delusions by the use of the electro-static breeze.

In addition to the benefit derived from static electricity in mental diseases, we have obtained excellent results in neuralgias, myalgia, muscular rheumatism, and in nerve and brain fatigue. We have found it advisable in mental or neurasthenic cases to begin with a mild electro-static breeze and a short spark and gradually increase the strength of one and the length of the other.

As far as our observations go in regard to the immediate physical effects of this form of electricity, they corroborate, in the majority of instances, the statement that the temperature is slightly raised, if normal or subnormal; the pulse slowed, if fast, and there is often a feeling of warmth similar to the pleasant reaction after a bath.

In the "State Hospital's Bulletin" for July, 1896, Dr. P. M. Wise, superintendent of the St. Lawrence State Hospital for the Insane, reports six cases of insanity treated by static electricity as follows:

Case I.—Male, aged 46, epileptic convulsions since fourteen years of age, latterly also; simple melancholia. Treatment: Static bath five minutes, and a faradic application to the crown for ten minutes daily. Had but one convulsion in six weeks. Became cheerful and hopeful. After ten weeks continues to

improve, and patient ascribes his bettered condition wholly to his electrical treatment.

CASE II.—Male, aged 38. Melancholia of four months' duration. Six months after admission he arrived at a condition of fair nutrition with mild depression, but he did not respond to the application of further remedies, and gave promise of becoming a chronic case of melancholia. Treatment with static electrification and head breeze daily was followed by immediate improvement, and recovery in about three months.

CASE III.—Male, aged 27. Melancholia, duration two years, some evidence of dementia. Two weeks after commencing treatment with static spray, ten minutes daily, improvement began, and two weeks later he appeared fairly well. The only addition to the treatment by static electricity was regulated outdoor exercise, which had previously been tried without avail.

CASE IV.—Male, aged 43. Admitted in a condition of acute mania. Two months later had become quiet, but had reached a stationary condition when daily *séances* of static electricity were followed by immediate improvement, which continued to recovery.

CASE V.—Male, aged 51. Chronic melancholia of one year's duration without improvement. Static electricity was applied in ten-minute *séances* daily from July 16th to September 15th, 1895. July 18th: During the first five minutes of application the patient's hands trembled very noticeably and then became steady.

On the 30th of July it was noted that the extremities were cold before the *séance*. August 9th: Improving, does not require to be urged to accept further treatment.

CASE VI.—Male, aged 49. Subacute mania of two years' duration. Treatment, static bath alternating with head breeze. After ten days the case-book records: "His appearance improved. Patient very rational and asserts that this course of treatment is doing him good."

Discharged at the end of five months, recovered.

Dr. Wise adds that in many cases in which little hope of recovery was held, recovery ensued after prolonged treatment by static electricity alone. In one case of neuritis the patient's delusions were confirmed by attempting to walk suddenly after a *séance*. The cases reported were treated by static electricity alone. The ordinary form of application was positive electrification and the breeze. Sparks were seldom used except when

some local effect was desired. The first manifest results of this treatment are a quickening of the pulse rate, a flushing of the surface, and a stimulation of the excretory function of the skin. An improvement in nutrition, a brightening of the mental faculties, and improvement in appetite, increase in weight, and regularity of sleep, are the earliest symptoms of improvement. Dr. Wise believes that the current has a distinct effect on the vasomotor apparatus and acts as a stimulant to the circulation and nutrition.

Although the number of cases reported is small the results obtained both by Dr. Wise and myself, and the testimony of others, prove, I think, that in static electricity we have a very valuable therapeutic agent in the treatment of mental diseases, especially in all forms of chronic psychical depression, and that a certain number of the latter class of cases whose recovery seems hopeless may by persistent treatment with some form of static electricity be restored to health, or at least to a condition of some comfort and usefulness in life.

The above exceedingly interesting report, communicated by Dr. Knowlton in a personal letter to the author, is an important addition to the subject of electro-therapeutics in the treatment of mental diseases. My own personal experience cannot go so far as the cases cited above, for the class of patients which I receive into my own residence for treatment fall short of the states which require hospital care. I have, however, very decided convictions about the value of the entire resources of electro-therapeutics in the treatment of all forms of mental alienation in which there remains any possibility of improvement or recovery. Cases dependent on progressive organic lesions do not come under this head.

The useful alternation of the galvanic current with static electricity in morbid mental states is comprised within a few simple methods which may be employed or varied according to convenience and results.

1. Apply the positive felt-covered electrode to the forehead and the negative over the lower cervical spine with a constant galvanic current of four or five mil. for about five minutes.

2. The positive electrode at the back of the neck over the lower cervical vertibræ and a small negative electrode pressed

deeply beneath the angle of the jaw. Pass a constant galvanic current of about 7 mil. for about five minutes.

3. Central galvanization.

4. A descending galvanic current down the entire spine of about 20 mil.

The general nutritional effects of general faradization may also be employed when it is possible to do so by those who do not possess a static apparatus.

It is by no means essential to treatment to arrive at an exact diagnosis at the first examination of each case, but by carefully studying the physical condition of the patient and directing treatment to produce the greatest possible improvement in that respect, the physician will have time to study the case and reach conclusions about the choice of methods.

Riggs considers that in melancholia especially electricity is a most valuable remedial agent. He says: "Again and again I have seen the hallucinations and fixed ideas, so well marked in this disorder, disappear under its use, and it is the general testimony of the profession that this psychosis is especially amenable to electrical treatment." The prognosis is much better in cases which begin treatment early.

He also says that there can be no question of the value of electricity in insanity of the climacteric period.

In these cases the resources of static electricity constitute the foundation of the treatment, alternated with the constant galvanic application through the brain and down the spinal cord. Local applications to the uterus as described under *menopause* should also be utilized whenever a determination of blood or nervous force to the pelvis will relieve the pressure in the brain.

CHAPTER L.

TREATMENT OF HYSTERIA.

Electricity in hysteria. Spinal irritation and hysterical spine. Hysterical paralysis. General treatment.

THE treatment of protean hysteria will enlist the full resources of the physician, but if electricity is employed symptomatic medication can many times be set aside. Hygiene and mental therapeutics may be utilized as far as they will go, but electricity should be added to them, and it constitutes a sheet-anchor among curative measures.

The ordinary and most frequently advised, yet most troublesome and least effective method of electrical treatment consists in "central galvanization and general faradization on alternate days, with local faradic exercise of any paralyzed muscles. If improvement progresses in a short time the *séances* may be reduced to three times a week. In some cases a course of two weeks' treatment will reinforce the nerve centres for six months or more before a relapse occurs. Then treat again."

In patients confined to the house for any reason, the electrical applications can of course be made only with portable batteries; but for persons that can or will come to the office, the static machine surpasses in value all other resources of therapeutics. There is no doubt of this.

Hysteria is a functional disease of the nervous system, characterized by a morbid susceptibility to mental emotions without will-power sufficient to control them. It also involves sympathetic nervous phenomena. There is frequently some un-

doubted relation between hysteria and uterine and ovarian disturbances. Violent mental phenomena arising from grief, disappointment, anger, fright, suspense, etc., are also among factors of causation.

These familiar facts in regard to hysteria are known to everybody, and the physician who will turn from them to a careful examination of the actions of different administrations of static electricity upon the nervous, circulatory, and muscular systems will find that it is a remedy which fits the disease as completely as mercury fits syphilis or quinine malaria.

Some of the directions for the management, control, and treatment of hysterical patients perpetuated in general works on medicine are unnecessary and unkind, and if literally followed would not be calculated to maintain further cordial relations between the physician and patient. Valerian and asafœtida are also ill-smelling stuffs to have in the house, and alcohol and opium, chloral, sulphonal, chloroform, etc., lead the patient down hill instead of up. Removal of innocent ovaries has time and again proved to be a vain procedure, and hysterical patients in general form a class who seem to have few rights that medical authors feel bound to respect. A cold bath administered in hospital cases is sometimes disastrous.

There are three indications for static electricity: (1) The improvement of the patient's general health; (2) the relief of symptoms; (3) a more or less permanent cure.

The management of an hysterical man or woman upon the platform of a powerful and well-handled static machine cannot be set forth in book form, and the secret of satisfactory results lies in a tactful controlling management of the patient rather than in set rules of treating the disease.

The static machine reduces the successful treatment of hysteria to practical lines, and no kaleidoscopic changes of symptoms in these cases can ever embarrass the therapeutist for a remedy, nor elude the searching out of some conquering breeze, spray, or spark from this versatile master of neurotics.

In genuine cases of hysteria with paralysis, aphonia, ovarian pains, backaches, joint pains, curious sensations, and all the vagaries which this neurosis may present, static electricity is the sheet-anchor.

The basis of treatment is a most thorough constitutional application of positive charge for eight or ten minutes, or potential alternation in suitable cases, together with head and spine localizations of the positive breeze or spray; and later when required positive sparks to the spine, affected muscle groups, painful nerves, hysterical joints, the lumbar and ovarian region in women, and the lumbar centres and perineum in men.

Some of these patients complain of one form of application while they welcome another, and their feelings should be regarded; but as they sleep better, grow brighter in spirits, experience less irritability, and yield to the gradual influence of the sedative-tonic static current, they usually become eager for it and are convinced of the benefit it imparts. If a patient's mind occasionally takes the opposite view, the treatment should not be urged.

Spinal Irritation and Hysterical Spine.—Seat the patient comfortably upon the static platform with the positive pole connected to it. Ground the negative pole and administer simple sedative electrification for about ten minutes. Then ground the brass point electrode and administer a soothing agreeable breeze up and down the spine and upon the head by long sweeps of the electrode.

At tender spinal points concentrate the breeze into a warming and anodyne spray, and, if it is possible to cause any aggravation by movement or posture, have the patient do so and persist till the pain is gone.

As soon as confidence is established, encourage the patient to accept mild sparks over the spine and lower extremities, and also the ovarian region if symptoms indicate. Repeat daily if possible, and a few sittings will usually complete the relief.

Clinical Remarks.—Static electricity especially commends

itself to hysterical patients, both by reason of its beneficial effects and the facility of its administration without removal of clothing. Some tact is, however, required in the management of electrodes for local applications until the confidence of the patient is established by the benefit obtained. A patient in an extremely unsettled state will often regain a degree of composure after ten minutes on the platform which she would not have believed possible before she experienced it.

It is at the first visit and during the first treatment that caution is required, for if a patient is pleased and benefited the treatment will go on agreeably, while if careless or rudely performed applications are abruptedly made, the second visit may never come.

A word of assurance to the patient and a gentle manner is always advisable. The very gradual approach of an electrode which the patient sees for the first time is very much more judicious than the startling effect of a sudden spray or spark, which the patient does not understand and for which she is not prepared.

Managed in a sensible way a preliminary sedative electrification will prepare the nervous system for a local breeze, the breeze will pave the way to the stronger spray, and the spray will prepare the tissues for mild sparks. When mild sparks are applied with comfort to the patient there is no further difficulty in increasing their vigor if there is any temporary need at any time of a few long and powerful sparks.

Hysterical Paralysis.—There is but one form of electric current which is practically feasible for the general treatment of hysterical patients. I refer to the current *which requires neither disrobing of the patient nor the contact of electrodes with the skin.* In my own practice I would almost as soon think of combating the vagaries of hysteria by asking the patient to stand on her head as to attempt general treatment with galvanic or faradic currents. Local applications are a different matter.

Seat the patient upon the static platform in a comfortable

chair and without removing any of her garments. Connect the platform with the positive pole of the static machine, ground the negative pole and start the plates into slow action. Increase the rate of speed in proportion to the mental state of the patient, and if she is full of confidence and considers herself possessed of "very strong will power," there will be little need of delay in educating her to appreciate the benefits of the static breeze and sparks.

If she is neurasthenic and alarmed, the first chapter of treatment must ignore the paralytic symptoms and attend solely to the mental state. Try to secure daily attendance for general tonic electrification and add to this as rapidly as possible the positive breeze to the head and spine.

It is often possible by tact and management to obtain control, in two or three sittings, of a case which has perhaps already taxed the patience of a dozen medical prescribers and neurologists. As a matter of fact the treatment of hysterical, neurasthenic and neurotic patients of all classes without the aid of the static apparatus is filled with difficulty and dissatisfaction to both parties. Those who neglect static electricity in nervous diseases lose many patients.

As soon as full control over the mind of the patient is secured the symptoms of paralysis, pain, spasm, etc., can all be attacked by static sparks and spray applications, beginning with mild intensities and gradually increasing the dose. The pelvic manifestations can be treated at the same time, and the neurotic and reflex symptoms of every part of the body are often amenable to the breeze, sprays and short, or long, spark.

The centres of the spine should be subjected to counter-irritant applications by rubbing the brass ball electrode rapidly over the surface for a moment at a time during the part of the sitting devoted to spark treatment and when the platform is connected with the negative pole.

No one can say in advance whether a given case will require a shorter or longer period of this treatment, but it rapidly conquers the nervous system of the patient, compels involun-

tary appreciation, and produces such decided benefit that treatment is eagerly anticipated and looked forward to with confidence and hope. Unless some unforeseen occurrence or perversion of the patient's mind causes her to suspend treatment, the final result will almost invariably be good.

If the muscles of the arm or of locomotion are affected, the next step is to enforce their functional activity by the slowly interrupted faradic current. Treat leg as follows:

Seat the patient in an ordinary chair. Connect a flat electrode of any kind to the positive pole of the high-tension induction coil apparatus and place it first under the ball of the foot. Moisten an ordinary sponge-covered hand electrode in hot water, lubricate it with a little soap and connect it with the negative pole.

Switch into circuit the combined No. 21 and No. 32 coils, four or five cells, the slow vibrator (about 80 interruptions per minute) and move the negative electrode about over the different muscle groups below the knee. Regulate the dosage in the usual manner so as to cause contractions which are vigorous without being fatiguing.

After exercising all the muscles below the knee, have the patient hold the positive electrode upon different portions of the thigh while the negative electrode is again passed over the different muscles. The positive electrode may be held first upon the outer side of the thigh muscles just above the knee, then upon the inner side and finally higher up so as to exercise all the muscles between the knee and the hip joint. Increase the current strength as required for the larger muscles and treat the paralysis in exactly the same way as if hysteria had nothing to do with it.

Arm muscles may be treated on the same principles.

CHAPTER LI.

TREATMENT OF CHRONIC CACHEXIAS.

Chronic malarial cachexia. Syphilitic cachexia. Malaise. Chronic cachexias in general. Epilepsy. Acute or chronic grief.

In quite a number of conditions of ill-health valuable assistance is derived from electric currents in arousing reactionary forces. In these chronic dyscrasias *central galvanization* is the only general method of using the galvanic current, and *general faradization* is the only general method of using the faradic current. Static electricity may however be employed advantageously in a number of ways without any removal of clothing. It thus becomes the chief current in the treatment of these general conditions, and as such will be considered in this chapter.

Chronic Malarial Cachexia.—In addition to indicated drugs a decided benefit to the patient is produced by static electricity. Positive electrification for fifteen minutes repeated daily or every second day is decidedly helpful in combating the electro-negative cachexia of malaria. Sparks, mingled with a stimulating spray from the brass point electrode, up and down the spine and over the spleen and liver, should be applied for about five minutes before the close of the sitting.

Similar treatment is exceedingly effective in hastening the

return of strength after an acute attack of "chills and fever," and when applied at the onset of a chill will abort it; at least this has been the author's experience in a number of cases.

Syphilitic Cachexia.—Static electricity does not treat syphilis or any specific poison. Inasmuch, however, as the later stages of this disease are sometimes complicated by conditions and symptomatic derangements which call for local relief or constitutional measures of a tonic character, it is well to remember that in the Holtz machine we possess an efficient means of giving symptomatic relief and nutritional aid to the patient even though a cure of the syphilis itself depends on other remedies. Electricity will act harmoniously with these remedies and add considerably to the patient's satisfaction.

I have rarely seen—never to my present recollection—a weak, cachectic, anæmic man, suffering from head, joint, or muscle pains, nervous or circulatory disturbances, or any of the functional miseries that sprung out of Pandora's box, refuse to receive the usual benefit from static electrification because he once had syphilis. I have seen a persistent headache in a well-nourished and powerful man which was not at first suspected to be syphilitic, but which incapacitated the man from work, remain relieved for twenty-four hours after the application of each static head breeze repeated three times a week.

When any pain is promptly relieved but promptly recurs again in this manner during static treatment, it is diagnostic of some cause not previously suspected but which is not amenable to the action of the current. A closer examination of the patient should therefore always be made to discover and remove the underlying cause. In this case the patient finally admitted what he had at first denied, and upon taking a mercurial, or rather mixed treatment for a week, and omitting the static application, his headache remained as bad as ever. He accordingly returned again for the static application which he had found to afford him such welcome though temporary relief,

and this time there was a rapid improvement of his general condition and the headache soon ceased to give further trouble.

While it may be assumed that in any chronic disease upon which medication exercises a slow and gradual influence the patient will receive in time the full measure of relief from symptomatic manifestations, yet there is something eminently satisfactory to the patients in accelerating these benefits and in providing them with an immediate sense of well-being, renewed energy, muscular strength, and relief from disturbing symptoms. If the faculties are thick and dull they are wonderfully cleared and refreshed by the positive breeze on the spine and head.

Malaise.—When the condition of malaise, languor, and inability to exert the faculties in any desired work is due to temporary functional derangement, it is removable in a few moments' time more certainly and permanently by static electricity than by any other medical means. Even if quinine, or an unloading of the portal circulation, or any other procedure is also required for lasting effects in malaise of a more deep-seated character, the static application will give immense immediate relief.

Seat the patient upon the platform connected with the positive pole and ground the negative pole. Between the metal tray and the patient's feet insert the usual mat of protecting material, and administer about ten minutes of potential alternation.

The restorative effect of this method will be enhanced by a mild application of positive sparks to the general surface of the body before closing the sitting, in cases who will receive sparks agreeably.

Chronic Cachexias in General.—In these depraved states of whatever sort—whether malarial, pulmonary, specific, or any other condition susceptible of relief from harassing symptoms, and temporary if not permanent constitutional improvement,

the general and local methods of static applications are of practical value.

The basis of treatment will be general positive electrification for fifteen minutes if no local application is required in the individual case.

Other measures such as the spinal or head breeze, sparks to the spine, abdomen, liver, spleen, extremities, or special nerve trunks, should be engrafted upon the simple tonic electrification, either for the relief of local symptoms, or in almost every case for their additional effects upon nutritional activity.

Both medical and hygienic resources need all the aid they can get in the treatment of these chronic and often incurable conditions. Static electricity is the most practical and useful auxiliary remedy that I know of, and can do more to promote comfort, and re-establish as near a state of health as is possible, than many things commonly recommended. The patient is very much more certain to be benefited by three months of treatment with the static machine than by three months of travel and change of climate.

Frequency of treatment should be regulated by the effects upon the individual patient. Daily *séances* are advisable until benefit from a single treatment is fully maintained for more than twenty-four hours. Applications may then be made every second day, and finally the patient may return for treatment only when the need of it is felt.

Those who have learned not to expect to cure all the chronic ills that flesh is heir to, but are thankful to be possessed of a means which will help them improve the condition of patients who are likely never again to enjoy sound health, will obtain the greatest possible aid from a skilfully handled static machine.

Before undertaking these cases the physician should ground himself in the study of the physiology of static currents and the operation of the apparatus.

The Treatment of Epileptic Patients with Static Electricity.—In so far as the individual is in poor general health

with depraved nutrition, aggravated perhaps by the depressing effects of drugs, benefit may be reasonably expected from static administrations. The seizures may also be reduced in frequency. In cases associated with pelvic derangements, the gynecological applications of galvanic and faradic electricity will also do much to improve the condition.

Of the actual cure of epilepsy, however, I have nothing to say. In young subjects, whose attacks are recent and apparently due to some exciting cause which static electricity will ameliorate, the prognosis would be better.

One thing is certain, and that is the general toning-up of the whole nervous system which will take place during a course of static treatment. This is well worth securing in almost every case which has long been subjected to the influence of bromides.

Two years ago I attended a patient about fifty-one years of age, whose epilepsy had been "traced to the ovaries" by one of the most distinguished gynecologists of this generation. During the pioneer days of laparotomy he had removed this lady's ovaries without any subsequent effect upon the epilepsy. When she died suddenly with fatty infiltration of the heart, the autopsy which I attended disclosed the fibrous bands of a localized old inflammation of the dura, and the epileptic seizures were attributed by the pathologist to the irritation at this point.

This case shows how uncertain the removal of ovaries, the application of electricity, medical or other remedies, may be in the treatment of epileptic patients.

It may be said of static electricity in its relation to epilepsy that quite a number of physicians have had different experiences with it, and that in cases which have the least amount of structural change as a cause the prognosis is most favorable; and in all cases the general health of the patient will be benefited if this is below par. Each case, however, must be considered by itself and the patient should be treated without any promise whatever.

Dr. F. A. Kraft, Milwaukee, Wis., reports the following case:

Epilepsy.—Mrs. L. M——, a lady, 32 years of age, presenting a severe case of epilepsy, which was the result of fright dating back about four years.

The lady was in perfect health previous to her first attack. The epileptic fits were of great severity and occurred on an average of twice in three weeks. Her appetite was very poor; the bowels did not move unless a cathartic was taken. The patient looked like a shadow, and her family despaired of her life.

I recommended static electric treatments and began to give the same, one every day for thirty days, prescribing additionally compound syrup of phosphate. On the seventeenth day from beginning of the treatment she had a slight attack of an epileptic fit, lasting only a few minutes. Her appetite improved, she gained nine pounds during the first month, her appearance has changed for the better, and constant improvements are recorded. After the thirtieth static application I lessened the treatments to one every other day, and gave her twenty more.

The results were incomparable to any case of this kind I ever had to treat. The 3d of September, 1896, the lady looked like the healthiest person that ever lived, had gained two and one-half pounds during the time of her taking treatment, which after the fiftieth call I diminished to two treatments a week, and although I cannot pronounce her case a complete cure, it has plainly shown what results are obtainable from proper systematic treatment with static electricity.

P.S. November 30th, 1896: the lady, Mrs. L. M——, had to this day not a single attack of epileptic fits, feels well, and I think the case will result in a complete cure.

Acute or Chronic Grief.—The effects of grief upon the human organism are often equivalent to the effects of a slow-acting poison. Grief and shock, from a medical standpoint, are conditions admirably considered in the following citation from a recent writer:

Medical observations show that the physical result of depressing emotions are similar to those caused by bodily

accidents, fatigue, chill, partial starvation and loss of blood. Birds, moles and dogs, which apparently died in consequence of capture, and from conditions that correspond in human beings to acute nostalgia and "broken heart," were examined after death as to the condition of their internal organs, and it was found that the nutrition of the tissues had been interfered with, and the substance proper of various vital organs had undergone the same kind of degeneration as that brought about by phosphorus or the germs of infectious disease. To urge work, study, travel, the vain search for amusements, is both useless and dangerous. For a time the whole organism is overthrown. Readjustment comes slowly. Sorrow, grief and all great misfortunes should be regarded as conditions similar to acute infectious diseases, which they resemble in result, and later as convalescence from such diseases. Seclusion, rest, sleep, appropriate food, fresh air, sunshine, interests that tax neither mind nor body, these are requirements in this class of illness.

To this writer's therapeutics for this class of cases should be added general electrization. No one informed of its nerve-toning properties and nutritional effects could withhold from these patients a remedy equally indicated with sunshine, diversion and rest. I have had the opportunity of corroborating its effects in tranquillizing overwrought emotions and in the profound melancholia of sorrow, also in severe shock, two cases of which I recall very distinctly, and my views of the value of nutritional, sedative-tonic electrization have been confirmed by personal experience in a large number of instances. It is more rational and satisfactory to all concerned to treat intense grief as a disease and shorten its duration by the efficient use of electricity than to leave the patient to time and circumstances to outgrow it.

In the treatment of the great class of diseases and symptoms which require functional regulation or nutritional improvement, general restorative measures are nearly always indicated. So far as these come within the resources of electro-therapy the advantages of static applications are decided.

Static treatment may be quickly given without taking off a garment, and its physiological action upon the general func-

tions and the processes of nutrition are more practically available than similar actions of other currents.

In office practice the static machine will enable the operator to retain cases that he would otherwise abandon, or who abandon him because of discouragement as to results. The loss of these cases will soon offset the cost of the machine.

Although facility of application is a point that is justly dwelt upon by every experienced operator of the static machine, and short *séances* are cited as the rule, yet too much haste is not advisable in general administrations. The beginner especially will do well to take plenty of time. Much better results will accrue in the long run to the operator who takes fifteen or twenty minutes to do deliberately what only an expert can crowd into half the time.

CHAPTER LII.

CHRONIC GOUT AND THE URIC-ACID DIATHESIS.

Chronic gout. Methods of treatment. The uric acid diathesis. Value of static electricity in treatment. Effects of diet. Status of drug treatment.

In addition to the ingestion of large quantities of water, the regulation of diet, and the usual medical formula, the treatment of gouty patients is generally supplemented by baths, exercise, massage, stimulating ointments and lotions locally, etc. The treatment of gout is frequently written up at some length and with great ingenuity in suggesting methods by which extra-drug treatment may be best pursued. Every one of the indications cited in various writings which I have examined is fulfilled by static electricity, and the best and safest means of obtaining all the results which can be accredited to all other extra-drug agencies is found in the hands of the physician who possesses a Holtz machine.

If "active exercise" will benefit a gouty patient the energizing static current will prepare him to take it with endurance and enjoyment, and if he becomes fatigued in an excess of enthusiasm his next static treatment will banish the ill effects. If "passive exercise in the form of massage" is indicated, there is no masseur endowed by training or by capabilities of technique with the deeper-acting, more quickly administered, and infinitely superior massage of the static spark. The potential difference between the hand method and the electric-current method is as great as the difference between a hand machine and a steam engine.

If "baths are indicated to aid elimination," I refer the reader to the investigation of the physiological action of electrical cur-

rents upon inactive processes of metabolism set forth in a preceding page. If a joint can be benefited by "an ointment containing iodine, iodide of potassium, ichthyol, or extract of belladonna spread on a piece of lint applied as a plaster and kept in place by a flannel roller bandage," we have simpler methods that are neither greasy nor odorous, covering all the range, from the sedation of an exquisitely painful and tender state to stimulation, counter-irritation, and strong contractions of muscles and ligaments.

Some of the methods advised, especially "a course of baths and massage or a visit to a mineral spring," take the patient out of the hands of the physician, with an increase of expense to the invalid and no compensating advantage to either the patient or his doctor. The static machine, on the contrary, retains the full, uncomplicated control of the patient, treats him more successfully and with less expense than the masseur or the spa, and gives the physician who operates it the combined satisfaction of serving at once his patient's best interests and his own financial necessities for the support of his family.

Seat the patient upon the platform connected with the positive pole, ground the negative pole, and apply general positive electrification for fifteen minutes. After one or two treatments change to potential alternation, as it is the most actively alterative and tonic method.

Upon this nutritional application the local method must be adapted to suit the case. If a joint is acutely inflamed, swollen, and exquisitely painful and tender, the patient will hardly be likely to come to the office and will be treated by the usual methods at his house; but should the condition be such as to permit office visits, the relief of the positive static spray concentrated upon the part for about ten minutes will be a wonderfully efficient aid to the "calomel, colchicum, codeine, and other drugs customarily prescribed." Repeat as often as the return of pain and circumstances indicate. The patient who has once experienced the great relief of the static breeze will want it again.

If the joint condition is one in which "local massage is said to be of great service" the local static application may begin tentatively with sedation, if a low grade of inflammation is suspected to be still present, and the operator may gradually mingle an occasional mild spark with the sedative and alterative spray, but increase the dosage to stronger sparks as the improvement advances. This will massage the joint most effectually.

If there is only deformity present without inflammation it is advised that "the massage may be more vigorous, and movements of the joints with stretching of the contracted ligaments should be frequently and systematically carried out. By this means the deformities, when they are due to contraction alone, may be entirely overcome and the full use of the joint restored. The application to the joint of stimulating ointments and lotions is also of considerable value. Of course, if there are chalky deposits within the joint they can never be removed."

Under these conditions apply to the joint long, thick percussion sparks, carefully regulated from very mild to strong, according to the increasing tolerance of the tissues in the course of improvement. Avoid applying the spark to any node or bony prominence uncovered by muscle if the spark causes any particular pain in this situation.

To affect the gouty diathesis after the patient has become accustomed to spark treatment, close each sitting by a thorough nutritional treatment of the whole body. Go over the spine, arms, abdomen, region of spleen and liver and entire lower extremities with positive sparks.

Frequency of treatment must be governed by the duration of the effect after each sitting. When the improvement is maintained for more than twenty-four hours and is progressive, the applications may be made every second day and later three times a week. When the patient remains free from symptoms and maintains a satisfactory improvement for an interval of about two weeks, treatment may be discontinued until some relapse occurs.

In all this class of cases it is sufficient satisfaction to be able to keep the patient comfortable year after year by temporary treatment whenever symptoms require, but the tendency to relapse would of course be greatly mitigated by adding to dietetic precautions an occasional short course of static treatment at intervals throughout the year, regardless of any apparent necessity.

The Uric-Acid Diathesis.—The medical man who operates a powerful Holtz machine in his office practice possesses a means of mastery over this renowned condition that far surpasses the therapeutics of Haig. The diet-and-drug method strives to adapt the patient to the diathesis, in fact capitulates to it; supplementing these measures with static electricity drives the diathesis out and necessitates no compromise with the powers of malnutrition.

Nerve and muscle excitation are the familiar electrical effects commonly quoted by those who have no other knowledge of electro-physiology, but these are far surpassed in nutritional importance by the decisive effect upon the metabolism of the organism by currents of high frequency and high potential. Apostoli and D'Arsonval have lately demonstrated, and many others have confirmed, this profound effect upon nutrition,* increasing the elimination of urea, carbonic acid, and water by from forty to fifty per cent, and reducing by a corresponding amount the uric acid in the system.

On the one hand the consumption of oxygen is increased, metabolic completeness is increased, and the products of incomplete combustion are diminished on the other hand. It is certainly better therapeutics to dispose of uric acid by carrying its oxidation on to urea than to prescribe solvents which do not lessen its production and which only palliate the evil.

The treatment of these cases by the addition of static electricity to other methods involves the general application of the

* These effects were practically observed and recorded by the careful and accurate investigators of 1770–90. See chapter on electro-physiology.

positive current, preferably by the author's vibratory potential alternation, followed by nutritional sparks to the general surface, and the localization of either breeze or sparks wherever they may be needed for the relief of painful or other symptoms presented by the patient.

While the sense of well-being imparted to the patient in a few moments is exceedingly grateful and may last for a few hours, or the remainder of the first day and night, yet if the apparently prompt relief deceives the physician into short sittings at intervals of only about two or three times a week, the progressive advancement of the case will not be rapidly assisted.

Inasmuch as the processes of nutrition are at fault, and are taxed beyond their functional powers three times a day, it is evident that one treatment in three days has too much against it to permit its successful operation. The improvement which follows a few moments' influence of the current should not only be maintained by treatments of nearly half an hour in length, but the second treatment should take up the benefit and carry it on before it is partly or wholly lost by delay. The most satisfactory results in the treatment of these patients will be obtained by thorough nutritional applications daily, until there is no gain lost by making them every second day. When improvement is established to this point it will soon be possible to finish the case with a few treatments three times a week. Repeat the same when relapses occur.

From a fresh perusal of the chapter upon the physiological effects of high potential high frequency currents upon nutrition and functional process (see Chapter IX.) let us now note a recent summary of that portion of treatment which relates to diet and drugs.

Some Effects of Diet on the Excretion of Uric Acid.—I have for many years been pointing out that a large number of diseases are due, entirely due, to the presence of excess of uric acid in the blood and tissues. In the course of my investigations I discovered that uric acid could be introduced into the

body and blood by the simple process of swallowing it. It had previously been believed and taught that uric acid when thus taken was converted into urea, and did not remain as uric acid in the blood or tissues. Now this discovery, made by me in 1892, has already given us a very great increase of power to control the quantity of uric acid in the body and blood, for it has shown that the uric acid of pathology is to a very large and important extent made up of the uric acid which is swallowed day by day in the food; and as it is quite easy to control this, we step at once into possession of a very important power of control over all diseases due to uric acid, in so far as they are functional and have not already produced structural and organic changes.

* * * * * * *

I think we may conclude that it is possible by avoiding entirely all animal foods that contain xanthin compounds or uric acid, and also tea, coffee and cocoa—whose alkaloids are similar xanthin compounds—to limit very greatly the introduction of uric acid into the body, and when the stores and accumulations already in the body have been eliminated to keep the excretion of uric acid in the urine always below the relation to urea of one to thirty, and that when this has been done all functional disease due to excess of uric acid in the body and blood will diminish and disappear.

Now it will very probably at once be asked how we are to tell in any given case when the body is clear of uric acid, and when the possessor of it may therefore expect freedom from uric acid disease?

I think that this can be done by means of a dose of salicylate of sodium, for when the body is clear of uric acid a dose of that drug will no longer make it rise to any great height above urea.

I think, also, it may be safely said that if any one takes an equivalent dose of salicylate of sodium and gets as the result an excretion of uric acid greatly above the relation to urea of one to thirty, such person is by no means free from uric acid or the disease it may cause, and is either introducing considerable quantity of uric acid with his daily food or has still considerable stores of the substance waiting to be dissolved out of his tissues.

By altering the diet it is possible to diminish very decidedly the excretion of uric acid, and even in a few days to make it less; but it will take many months—possibly twelve to eighteen, or more—to clear out the stores and accumulations.

The required alteration of diet is governed by very simple rules, which can be grasped by any one in a few moments of

thought. We have to cut out from "ordinary diet" all articles that contain either uric acid or xanthin compounds that can be converted into it, and we have thus to eliminate all animal foods except milk and cheese. But we must provide nitrogen enough to keep urea constantly about three and a half grains per pound of body weight per day, and we must therefore replace the animal foods left off by other things containing albumens. Now this can be done chiefly from three sources: (1) milk and cheese; (2) pulses, as lentils, peas, beans, dholl, etc.; (3) cereal foods, as wheat, barley, oats and things made from them. And when we consider that meat contains about 25 per cent. of albuminates, while the pulses contain 22 per cent., cheese 33 per cent., the cereals from 8 per cent. (as bread) to 10 per cent. (as oatmeal), and milk from 3 to 4 per cent., there can be no difficulty in replacing one class of foods by its equivalent in the other, so that urea, nutrition and strength shall remain unaltered.

The diseases that react to this treatment are practically the whole of those about which I have written, and it will be found that I have not made my claims one bit too large; for uric acid acts in the production of diseases (1) through the circulation which it controls throughout the body; and (2) as a direct irritant of fibrous tissues and joints, and the above control of the diet suffices eventually to control its evil activity in both these directions.

The diseases which best and quickly give evidence of the good effects of this control are the purely functional ones, headache, mental depression and the high blood-pressure whch accompanies and causes them; these are followed at variable distances by anemia and other blood diseases, albuminuria and Bright's disease, epilepsy, gout and rheumatism. On the other hand, it is quite possible, by administering uric acid in any of the forms mentioned above, to increase both the daily excretion in relation to urea and the amount that can be swept out by a salicylate. And with this and as its result, there will be a marked increase of all the functional troubles which are due to uric acid in the blood. When the uric-acid headache has been properly diagnosed and the above treatment carried out, I look upon cure as almost a matter of certainty, and much the same holds for high blood-pressure. mental depression, sleeplessness and other kindred troubles, Then with regard to Bright's disease, as some of its chronic forms are to be regarded merely as the last stages of unrelieved migraine, it follows that the cure of the functional disorder, which is both easy and certain, is equivalent to the prevention of the more serious organic disease. (*Alexander Haig, M. D., Brit. Med. Jour.*)

The status of drug treatment in the uric-acid state is fairly illustrated by the following extract from a recent journal article by Pritchett:

Each individual case must be considered separately and carefully. Water should be taken freely. The writer has used the lithia waters in the uric-acid diathesis, but has not seen the good results reported by others. Hot water taken before meals will be found beneficial. Daily bath should be taken.

If the patient is debilitated they should be warmed. If he is robust a morning cold bath with friction after it. An open air life, with plenty of exercise, regular hours and habits, are very important elements in counteracting the disease or condition.

As regards drugs, sodium salicylate will be found beneficial in many cases, but its effects should be carefully watched, especially if there is cardiac or renal insufficiency. The bicarbonate and citrate of potassium have been very satisfactory agents in my hands in the treatment of this condition. I have also used with much benefit the effervescent citrate of lithia tablets. Piperazine in my experience has not been attended with the success reported by some other observers. The iodide of potassium will be found useful in many cases. The preparations of guaiacum, quinine and the bitter tonics in combination with alkalies are of unquestionable benefit. The use of opium and coal-tar preparations should be avoided. Purgatives and laxatives should be used as indicated. Phosphate of soda is an excellent purgative in this condition; it acts directly on the liver and helps to keep the blood alkaline. It may be given in teaspoonful doses or more three times a day. The bichloride of mercury on account of its stimulating effects on the liver is an excellent remedy. It is best given three times a day in small doses with a good bitter tonic.

No single remedy can be pointed out among the above which will be satisfactory in all cases, but in all cases electricity will be useful and beneficial.

CHAPTER LIII.

FIBROUS AND EXOPHTHALMIC GOITRE.

Fibrous Goitre.—The treatment of cystic goitre by various electrical methods has been investigated very fully by different observers, notably by Dickson of Toronto. The results have been partially successful, but not sufficiently so to be satisfactory.

Fibrous goitres were formerly treated by electricity with fair success at a time when there was practically no other remedy in sight. Improvements in surgical and medical methods have greatly decreased the value of electrolysis. The method, however, may be stated here.

Moisten two felt or sponge covered, round electrodes, about two inches in diameter, in a one per cent. hot-water solution of bicarbonate of soda, connect them with the terminals of a galvanic battery and place them on the opposite sides of the growth. At different treatments the polarity can be alternated. Gradually increase the constant galvanic current through the rheostat from zero up to the maximum of tolerance. When the skin becomes irritated reduce the current a few mil. Maintain the action for ten or fifteen minutes, reduce to zero, remove the electrodes and dust the skin with an antiseptic powder.

Some have saturated the electrodes with a ten per cent. iodide of potassium solution. This external application should be employed at the first sitting and until the patient has become accustomed to treatment and has overcome any nervous timidity or fear of an "operation." It is of course slower in action and inferior to the puncture method and is only to be continued when patients refuse the latter.

Nevertheless, Everett writes of the external application:

In an experience of upwards of twenty years I do not recollect a complete failure to cure goitrous growth, or a failure to lessen the size of the tumor in every case. In a record of twenty cases treated in recent years with two exceptions a perfect cure was effected. In one case of a fibrous goitre of thirty years' standing the growth was lessened three-fourths in size and the distressing dyspnœa disappeared.

The tumor assumed a fibrous cartilaginous condition closely resembling a calcareous degeneration. In the other case the patient was far gone in tuberculosis and died before a cure could be effected, but in this case the tumor grew less in size and the symptoms disappeared.

In all these cases the general health is usually impaired and nutritional static administrations are very important. A few mild positive sparks also to the back of the neck and to the goitre are useful in relieving some of the symptoms which may occur.

Negative Puncture.—Shampoo the skin over the goitre and make it surgically clean. Moisten a felt-covered pad electrode, about 4 × 6, in a two per cent. solution of soda bicarbonate,

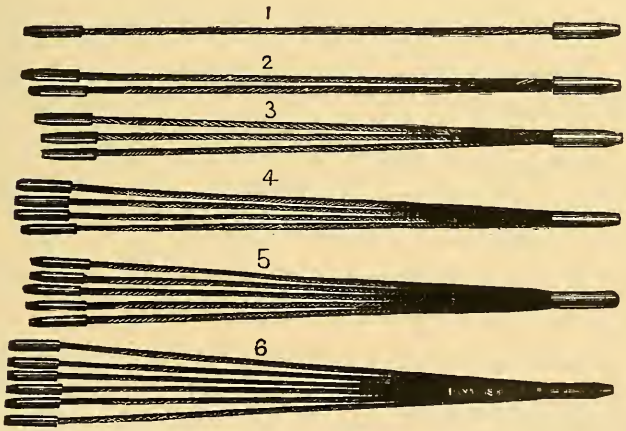


Fig. 380. Needle-holders with cord and tips.

Fig. 381.

connect it with the positive pole and apply it firmly upon the upper spine. Insert into the growth at different places from three to five sharp-pointed steel surgical needles and connect them with the negative pole.

Gradually increase the constant galvanic current through a rheostat until about three mil. per needle is passed for several minutes according to the action produced. Reduce the current to zero, withdraw the needles and apply a dry dressing with moderate pressure. Repeat after all irritation subsides, or once in from six to ten days.

The effect upon the growth is gradual, and no definite term of treatment can be stated in advance.

Intercurrent static applications should be employed for the general health, and if the external galvanic method is also employed every second or third day it may assist to hasten the result.

Exophthalmic Goitre.—In exophthalmic goitre I consider the use of galvanism to be a necessity no matter what other treatment be employed. The rapid and sometimes great fall in the pulse rate while the current is passing, as I have demonstrated it more than once to my classes, teaches me that whatever be the part of the nervous system essentially involved in causing the symptoms of this disease, it is affected in a marked manner by this method of treatment, and further, the relief to some of the other symptoms (especially the dyspnœa) that follows the application makes me almost willing to treat such cases solely by galvanism. (*O'Connor.*)

In any chronic case of this kind regulate the life of the patient, hygiene and diet, and prescribe the best medical remedies possible to employ in the individual case.

As exophthalmic goitre generally occurs in those who are nervous or hysterical and thus aggravates these neurotic states, derangements of nutrition and functions are the rule. One of the main things to do is to "relieve the terrible nervous condition." For this purpose the chief resource is the static apparatus.

General Electrical Treatment.—Seat the patient comfort-

ably upon the static platform connected with the negative pole. Adjust the head breeze electrode about fifteen inches over the vertex. Connect this electrode and the positive pole to the same grounding. Start the machine into moderate action. After about eight minutes, swing the electrode to one side and ground the brass point electrode. Sway it in the usual manner up and down the spine sufficiently near to produce a sedative-tonic effect. Concentrate next a strong spray over the region of the great nerve centres of the cervical spine.

Add to these whatever local and nutritional applications may be indicated by the symptoms of a given case. It is only necessary to know what therapeutic effects can be caused by different methods of administration and how to apply the current to obtain them.

Repeat daily if possible and persist in the treatment until no more improvement can be obtained. Afterwards repeat the applications from time to time when aggravations occur.

Those who unfortunately do not possess the indispensable static apparatus will be obliged to resort for general nutritional effects to general faradization. This requires the disrobing of the patient and from 40 to 60 minutes' time. The technique is described in another chapter. The effects are similar in principle to those of general electrification by means of the static apparatus. After fulfilling the above general medical and electrical indications local applications of the galvanic current are to be employed in conjunction with the foregoing measures.

Local Electrical Treatment.—Wrap a large soft sponge moistened in a one or two per cent. hot-water solution of bicarbon-

Fig. 382. Carbon disk electrode.

ate of soda around a large carbon hand electrode, connect it with the positive pole of the galvanic battery and apply it to the spine over the lower cervical vertibræ. Moisten an ordinary sponge-covered hand electrode in the same solution, connect it with the negative pole and place it high up upon the neck at the base of the occiput.

Gradually increase the constant galvanic current through the rheostat to between 10 and 15 mil. In about two minutes gradually move the negative electrode forward upon one side of the neck until it is pressed into the auriculo-maxillary fossa. Regulate the current strength to comfortable tolerance of the skin, which, with properly moistened electrodes, ought to be 10 or more mil.

Slowly promenade the electrode down the inner edge of the sterno-cleido mastoid from the ear to the clavicle. After two minutes' application on one side of the neck repeat upon the other.

Next freshly moisten two similar electrodes and place the positive over the back of the neck or on the goitre and the negative over the apex of the heart. Gradually increase the constant galvanic current from zero up to about 10 mil. In about three or five minutes shift the electrode from the heart to the epigastrium and gradually increase the current strength to the maximum of tolerance, even as high as 40 or 50 mil. if it is well borne and productive of good.

This technique comprises about the best that can be done by the galvanic current, although local applications with both galvanic and faradic currents have been made by different writers to almost every situation between the eye and the heart where an electrode can be applied. Some place the positive electrode on the goitre and the negative on the abdomen. Some attempt to reduce the protrusion of the eye by placing the positive galvanic electrode upon the back of the neck and a negative over the eye, and employing mild currents to effect absorption.

While electricity is admitted to be more generally useful

than any other one agent, yet any treatment must be long continued to prove very beneficial.

It is worth noting that "resection of the cervical sympathetic" in the treatment of exophthalmic goitre aims at about the same result as the local galvanic application to the same part, and the reported results of surgery offer nothing in its favor over electrical treatment. "Jonnesco concludes (January 16, 1897) that total bilateral resection of the cervical sympathetic, while not easy, is worthy of trial, and in cases of exophthalmic goitre whose symptoms are largely referable to the cervical sympathetic resection is an absolute indication, even if supplemented by ligation of the vertebral artery."

The majority of physicians and patients will however doubtless prefer to combine the resources of medicine and electricity before adopting this operation.

CHAPTER LIV.

TREATMENT OF PULMONARY AFFECTIONS.

Effects of electrical treatment in relieving symptoms and promoting nutrition. Method of treating the local and general conditions of patients. Important actions of various applications. Clinical cases. Chest pains of pneumonia. Treatment of asthma. Faradic applications in diseases of the chest.

In all the various degrees and stages of bronchial and pulmonary affections one thing is usually certain—the patient is below par and needs reinforcement of tissue resistance.

Relief is also often desired from distressing symptoms which drugs either relieve slowly or palliate only with depressing or injurious effects upon digestion, the heart, or general health. I particularly refer to the common use of opiates in cough mixtures and for the relief of chest pains.

Static electricity will relieve some of these symptoms with a tonic effect upon nutrition. It will relieve the pains, the oppression in breathing, the sense of constriction behind the sternum, the inability to take a deep breath, the general debility, headaches, etc., and do something for the cough.

It will promote sleep, appetite, digestion, and general nutrition. It will exert some beneficial influence upon the catarrhal secretions, but it will not specifically act as an expectorant or destroy the tubercle bacillus.

It will aid appropriate medication in extremely useful ways, and many chronic invalids who are sent to distant climates would save money and thrive better at home with the family physician and the static machine.

Commence the course of tonic static treatment with simple positive electrification for ten or fifteen minutes, after which attend to special symptoms.

Stop the machine and change to negative electrification. If there is headache remove it with the positive head breeze. If there is backache in either the upper or lower spine remove it with a spray, or a spray mingled with mild sparks; or if it happens to be of a very chronic and obstinate character, which is occasionally the case, attack it with counter-irritant and more vigorous methods.

If there is soreness in the muscles of the chest, if the muscles are fatigued by coughing, if there are local pains of any character, if there is a sense of constriction, oppression, and the patient is unable to take a deep breath, have the patient sit erect with chin well up and electrified negatively while a positive spray from the brass point electrode is slowly swept with gentle motion across the whole area of distress.

After it comforts the soreness, have the patient inhale as deeply as possible while a single spark at a time is thrown from the point of the electrode in conjunction with the spray upon the places where pain is felt—upon the sternum and supra-mammary region of each side.

The sense of relief from every symptom afforded within three or five minutes cannot be duplicated by all the other resources of the materia medica. In cases which I have thus treated, the soreness and pain have instantly disappeared, the constriction has vanished, the muscles have been refreshed, and respiration has become full and comfortable.

If the extremities are cold, mild sparks to the cervical and lumbar spine and to the arms, thighs, and soles of feet will warm up the entire circulation.

If the heart action is weak and distressed, the sleep poor, digestion weak, appetite fickle, nerves irritable, and strength at a low ebb, the whole general and local treatment throughout the entire *séance* of about fifteen minutes will be steadily at

work improving the systemic state, increasing muscular strength, lessening the worst symptoms and banishing others totally—in short, accomplishing for the patient at home even in advanced states of the graver lesions and with moderate expense about the best results that could be hoped for by costly travel in search of a curative climate. Potential alternation is a good tonic method also.

If the ailment is an exceedingly minor form of cold in the chest without actually setting up any inflammatory exudation, the soreness and inability to take a deep breath have been removed time and again by the spray and mild spark application at the first visit of the patient to my office, and the relief has been permanent without any other treatment whatever.

If the patient has a history of a former attack of pneumonia, and examination reveals a diminution or total lack of expansion on one side, a very great amount of benefit will be produced, and expansion will be either partly or wholly restored by contracting the muscles with a slowly interrupted Leyden-jar current in exactly the same manner as a faradic current would be applied.

In all the previous applications the patient sits upon the static platform without any exposure of the person, and the treatment is therefore conveniently and quickly applied to all classes of cases.

To attempt to restore activity to the rigid or inert muscles, the clothing must be removed above the waist, and I am in the habit of placing the patient face downward on an operating-chair, with a sponge-covered electrode about the size of the palm of the hand under the solar plexus and connected with the negative pole.

Another ordinary sponge-covered electrode is then moistened, lubricated with soap, and promenaded up and down the spine and over the muscles of the affected side with a very rapidly interrupted high-potential current of just enough strength to produce a decided but comfortable thrill and some muscular

contraction when the electrode passes over motor points. This application increases the blood supply, warms and relaxes the muscles, and prepares them for more active exercise.

Very slow interruptions of about seventy periods per minute are substituted in about five minutes for the previous application, and each set of muscles is subjected to a dozen or more vigorous contractions, after which the back is dried and dusted with toilet powder and the sitting is at an end. This application may be repeated every second day until improvement is fully developed.

Of the action of static electricity in phthisis, Caldwell says:

> I have marked in a number of cases its tonic constitutional effects, and have found it possible to relieve many of the severer symptoms attendant upon advanced cases. The hectic fever, the night sweats, the weak heart action, and the cough will be relieved and the temperature lessened—all tending for the time being to make the sufferer more comfortable, and possibly prolonging life a little.

These are the common observations of experience in the treatment of incurable cases. In earlier stages of the disease it is obvious that the nutritional effects of static electricity are vastly more important than when all hope is passed and nothing can be expected except a little increase of comfort.

For the relief of irritative coughs in these ordinary cases when some simple anti-congestive and sedative action through the larynx will afford relief I sometimes include a few mild sparks to each side of the throat during the treatment, or apply, which is much better, a very rapidly interrupted small Leyden-jar current with a moistened sponge electrode directly upon each side of the larynx, with the dose regulated so as to produce as much tension as will still permit the patient to swallow.

Dr. W. C. Allen, Cranford, N. J., reports the following cases:

Phthisis.—Mrs. T——, the mother of three children, became much run down and developed a cough, and an afternoon rise of temperature to 100° F., night sweats, hectic flush in the afternoon, and marked hoarseness and soreness of the

larynx, and was beginning to lose weight; and there were physical signs of consolidation of the apex of the left lung; I gave her positive static insulation, and connected the negative pole with the wooden ball electrode, giving the current over the larynx and chest, both front and back; within three days the fever had stopped and by the end of the first week the night sweats were almost gone; she steadily improved in her general condition, gained in flesh, and the cough gradually diminished, and by the end of three months she was practically well, there being no cough, night sweats, fever, and only a very little of the hoarseness, and there has been no return of the trouble, and her last treatment was given over ten months ago.

Acute Pleurisy and Bronchitis.—Mrs. —— had an acute attack of simple bronchitis complicated with pleurisy at the base of the right side. She was treated as usual, at home and in bed, with medical remedies; but when able to get up she had an intense diffused pain over a large area of the side, a persisting cough, and it was a physical impossibility for her to take a big breath. After some days without change in this condition she came to the author.

She was placed on the static platform and connected with the positive pole; the negative pole was grounded with the brass point electrode. Sweeping the point over the affected region at a distance of about four inches I administered a hot stimulating spray for about three minutes. This disposed of the pain in the side.

The entire spine was then given a couple of moments' spray, and a few dashes of spray and needle sparks were thrown upon the upper chest and on each side of the throat. She stepped from the platform in a perfectly comfortable state, could draw a full breath with normal feeling, and felt greatly refreshed. She had stopped her medical remedies three days before as they "were doing no further good." She took no other medicine afterward. Her nagging cough underwent only a gradual relief and did not entirely disappear for a week, but the other symptoms vanished beneath the negative spray like the mists of morning before the sun, and never came back. She had only the one treatment and has since remained in her usual state of health.

Chronic Bronchitis.—Mrs. ——. This was a uterine case complicated with malaria and chronic bronchitis. I will not detail her history, and will refer here only to the portion of her treatment by static. She was very anæmic, emaciated, had

constant headache, backache, cough, and complained of her feet "swelling at different times." She had become greatly alarmed over the fear that she had consumption, and when first coming to me for treatment was dosing herself with patent medicines for the cure of this disease.

She had a number of reflex symptoms from her uterine condition, but an examination of the chest revealed no evidence of anything but the ordinary form of bronchitis. She received uterine treatment, chiefly by the bipolar method; had a simple prescription for the bronchitis, and between January 22d and March 5th received static administrations three times a week.

Her headaches and backache, reflex symptoms, and distress on breathing were absolutely removed at each sitting, and returned the next day with gradually diminishing severity.

In the course of two weeks she was free from headaches, sleeping much better and steadily improving. At the time of her last visit she was "well enough to get along" from her standpoint, although I should have advised another month of treatment.

In all these cases it is usually possible to do away with the difficulty in breathing and restore the capacity for deep inhalation in a couple of minutes by a process as simple as the turn of a hand. It is preposterous to claim that there is any resource in drug medicine which will produce these nerve and muscle effects which static electricity accomplishes with precision. They may seem "magical" to the patient, but they are nothing more than the ordinary physiological action of an interrupted current of very high potential and small amperage.

No physician who would investigate these actions and witness the effect of a single treatment upon, for instance, a severe case of muscular rheumatism could maintain his attitude of scepticism in regard to static electricity. Physicians who have never witnessed its action can hardly assert that they are competent judges.

In regard to the idea, which is often associated with complete ignorance about electricity, that the forms of applying it are "constantly changing," it might do to ask those who hold this view to point out any difference in either principle or

technique between the administration and effects of a static breeze one hundred years ago and to-day. There is no difference, and the best methods of the present time will apparently continue to be the best methods of the twentieth century.

Chronic Tuberculous Bronchitis and Extreme Anæmia.—Mrs. ——, aged 25, married, has had cough for two years. Chest examined; diagnosis second stage of phthisis. In this case as in others general nutritional applications of positive electrification with a spinal breeze were employed to build up her strength.

A spray with a few mild sparks across the upper region of the chest immediately increased her power of deep respiration and removed the chest pains. She had had only occasional night sweats, and these ceased.

All symptoms except the cough were entirely relieved at each treatment, and returned the next day with lessened severity. This woman was treated two and one-half months, three times a week, with some irregularity. When she got a little better she would dance half the night, or go on a shopping expedition, or do a hard day's work and cool off in a draught. Her relapses kept pace with her imprudences, and while she maintained an improvement in all symptoms but the cough, and had increased in general strength in a very satisfactory manner, she concluded that further treatment was not worth the trouble and expense.

This case is cited to illustrate an every-day experience in practice. Shiftless patients with diseases which are wellnigh incurable begin a short and desultory course of treatment with no better results than they deserve, and forever after say the remedy did them no good. The experience is common to all branches of medical practice.

The following cases are reported by Dr. J. A. Stratton, Newman, Cal.:

Chronic Bronchitis.—My work with a static machine extends over a period of about twelve months, and the results I have seen from its use have frequently gone beyond my most sanguine expectations. We generally read of its application in such diseases as neuralgias, rheumatics, neurasthenia, insomnia, etc., and I can say in such cases I am rarely disappointed in the

results that I get from its use, and I might say, in a large proportion of the aches and pains that the human flesh is heir to, the results that may be had from the proper use of static electricity are often little less than phenomenal. I firmly believe that its field of application will be greatly broadened as we learn more of its properties and see its effects in pathological conditions. I wish to call attention to a line of work that I have followed for a few months, just passed, in the limited number of cases that I have had, and if they get the same result that I have experienced, I believe they will be more than thankful for having their attention called to the matter. I refer to the use of static electricity in chronic bronchitis, and I do not know how to present this subject any better than to copy from my case book the symptoms, treatment, and result of treatment in some of my cases.

Case I.—Miss G——, aged 36, came to me January 15th, 1896, with the following history: Has had a cough for about five years gradually getting worse, and for the past two years her general health has been failing until at the present time is just able to walk around the room. Never sleeps but a few minutes at a time, and then only in an upright position, on account of great dyspnœa, which is greatly aggravated by exertion of any kind. At the present time coughs on an average thirty to forty times an hour, never goes as long as five minutes at a time without coughing. Expectoration is muco-purulent and very profuse and tenacious; no appetite; bowels constipated; menses regular but a scant flow. A constant irritation in the throat and soreness; voice very husky. A sense of constriction across the chest, and pain and soreness over the lungs, mostly in the back. Has been afflicted with a partial paralysis of the right side for years, which lately has become much worse, but she thinks it is on account of a general weakness. Has had medical treatment from many physicians both at home and from neighboring cities, but has never noticed any marked benefit from any treatment she has ever received but has continued to grow worse all the time. Some of her physicians told her she had bronchitis; others that she had consumption. The last one told her sister that medicine would do her no good and that she had but a short time to live. Examination shows abundant subcrepitant râles over both lungs, no cavities detected nor well-marked dulness, a dropsical condition of the abdomen and legs; she cannot raise the right hand to the head, or raise the right foot as well as the left.

Treatment: Static induced through the upper portion of the

chest, placing the electrodes just below the clavicle on each side near the axilla, passing the current ten minutes to the point of tolerance short of being painful, following with sparks up and down the spine, back, and legs, also over the abdomen, following with the spray over the head twenty minutes. This treatment was continued every other day for four weeks, with a marked improvement of all the symptoms she complained of when the treatment was commenced. In ten days after commencing treatment she expressed herself as feeling better, that she could sleep nearly all night, bowels were regular, and soreness in chest nearly all gone. After four weeks I gave her treatment every third day for about six weeks, when she said she was well, but I gave her an occasional treatment for one month longer.

Patient has not had any treatment for more than six months and says she is perfectly well, has been continually engaged in doing general housework, cooking, etc., for a large family for nearly eight months, and has had no relapse since the improvement commenced, which continued steadily almost from the first, is able to use her right arm and leg as well as she ever did.

Incidentally I wish to remark that I have never used anything in chronic constipation that relieves as quickly and effectively as the sparks over the abdomen. Most of my cases are relieved after three or four treatments, but I generally give about a dozen to clinch the cure and I have never had a patient return and say the cure was not permanent. I presume there are cases it will not cure, but it has never been my lot to have such a one.

Case II.—Mrs. B——, aged 43, July 23d, 1896: Patient has had a cough for fifteen years and came to California six years ago from the East for her health. Twelve years ago had pneumonia and has been in very poor health ever since, getting worse all the time. She has about every four or five weeks what she calls a relapse, when she is confined to her bed for several days and all her symptoms are greatly aggravated. These bad spells are constantly getting worse, has paroxysms of coughing several times a day, generally worse in the morning.

Expectoration is frothy and mixed with muco-purulent sputa; complains much of dyspnœa which is greatly aggravated by any exertions, marked distress in the chest which she describes as a sore pain; appetite poor, very much emaciated, and very weak.

Examination shows subcrepitant râles over all the chest.

Diagnosis: Bronchorrhœa.

Treatment: Same as in Case I. except omitting sparks over the abdomen as bowels were regular. Patient noticed improvement in her condition in a few days after commencing treatment. Is still under treatment and is gradually improving all the time. Has had three relapses since she commenced treatment, but they have been the lightest she has ever had; she was not compelled to go to bed, and recovered from them in a much shorter time than usual. Does her housework and assists in the washing and ironing, something she has not done for more than three years. Appetite is good and digestion fine; she is gaining flesh all the time. Says she is better than she has been for many years.

Case III.—Mrs. O——, aged 29. Patient has been troubled with a cough for six years, which is always worse at night, much soreness in chest and throat. The latter troubles her constantly and she complains more of it than of anything else. Cough keeps her awake the greater portion of the night. Expectorates very freely a muco-purulent sputum, often streaked with blood; appetite very poor and bowels constipated all the time; is not able to do any housework. Also suffers with uterine trouble. Patient was treated by the writer with medicine three years ago and greatly benefited, but now she says she is worse than she was before. Had a sister die from lung trouble, thinks it was consumption.

Treatment same as in Case I.

To-day, three months after commencing treatment, which has been very irregular, as the patient lives about fifteen miles in the country, she says her lung trouble is all right, she rarely ever coughs, and her throat has not troubled her for more than a month, while before commencing treatment it was sore all the time; bowels regular and have been so all the time since commencing treatment. I see by referring to my case book that I have given this patient nine treatments; she is still under treatment for the uterine trouble by the use of the galvanic current, and is steadily improving although very irregular in her attendance. She passed through her last menstrual period without any pain, something she has not done for a long time before.

Case IV. is that of the writer, who has had bronchitis for more than twenty years, and a few treatments given at irregular intervals have dispelled the cough entirely; he feels greatly relieved by not having his sleep disturbed by almost constant coughing. He never found any medication that gave more than

temporary relief. Has not coughed for months until recently, when he had an attack of acute bronchitis which is improving all the time and at present gives but little annoyance.

In conclusion I wish to call the attention of the profession to the relief they can give their patients with pharyngitis, even when complicated with rhinitis, by the use of the static induced current. I have many patients who are troubled with rhinitis complicated with pharyngitis, and I invariably find that a few applications of the static induced, passing the current through the throat from side to side, relieves all those distressing symptoms promptly.

Chest Pains of Pneumonia.—Haigh reports: "The constant galvanic current surpasses anything I have tried to relieve pain and promote absorption. Positive large electrode, a felt-covered pad, 6 × 10, over back, a negative similar electrode a little smaller in front over the site of pain. Increase the current to a comforting tolerance and maintain fifteen minutes or more if needed. I have just recovered from the disease myself and can personally vouch for the truth of the above, having tried its first from theoretical reasons."

Asthma.—The local applications of both galvanic and faradic currents recommended with various modifications by different writers do not appear to be successful. While a few apparent cures have been effected yet observers with many years' experience report that "galvanization of the pneumogastric," "central galvanization" and persistent "faradization" of the chest and neck have resulted in occasional temporary but not permanent benefit. As these methods involve some inconvenience and partial disrobing of the patient, and in the case of female patients consume time and are more or less unwelcome, I see no reason to employ them in practical work. Moreover they are often too local in their effects and may fail to take into account the general condition of the patient.

Ascertain as nearly as possible the entire condition of the patient, especially with regard to the digestive functions and pelvic organs, if female.

Regulate diet and hygiene, and if paroxysms are aggravated after eating, pay careful attention to a nutritious but bland diet. This is all the more important if the patient has already been over-drugged.

If any aggravation occurs at the menstrual period improve the circulation and functional action of the pelvic organs by bipolar faradization and percutaneous galvanic applications (as described in the section on gynecology) even if no pathological state can be detected by an examination. The pelvic treatment may be repeated about three times a week between periods. If any local lesion is detected follow the indications for treatment, either galvanic or faradic.

For its general tonic, nutritional and function-regulating effect the most reliable resource in electro-therapeutics is the static apparatus.

Seat the patient upon the static platform connected with the positive pole and ground the negative pole. At the first sitting administer only simple positive electrification for about 20 minutes. At the next visit connect the platform at first with the negative pole, ground the positive and the brass ball electrode. Explain to the patient the nature of the static spark and apply a few mild positive sparks to the general spine. Next, with the chin elevated and the current reduced, apply a few gentle sparks to the upper portion of the chest and also to the abdomen and ovarian regions. Next attend to any local symptoms such as backache, cold extremities and neurotic disturbances, with which these patients are often affected. Make this portion of the treatment cover the nutrition of the entire system. It requires less than ten minutes.

Next stop the machine, change the platform rod to the positive pole, ground the negative pole, and with the machine in rapid action administer simple positive electrification for twenty or thirty minutes according to the necessity for relief at each visit. Intercurrent applications of potential alternation are beneficial. The static treatment should be given daily for about a month, and after passing through a sufficient period

to allow a fair estimate of the progress made the treatment may be continued with less frequency until the improvement is satisfactory. When relapses occur in the future the same treatment may be resumed for a short time.

The function regulation action of the static current is shown in an interesting manner in these cases. I have both counted the respirations and listened to the sibilant rales before and after a sitting and have found that rales have almost completely disappeared, respiration has passed from shallow and rapid breathing to deep and comfortable breathing with 40 per cent. reduction in frequency, and this in a case which had been going steadily down hill under previous treatment in the hands of both family physician and specialist.

During treatment directed to permanent improvement the patient must continue for some time to depend for relief of a paroxysm upon the remedy found most successful in the given case.

General Electrification as a Restorative Tonic in Pulmonary Affections —The instinctive tendency of a patient seated on the static platform and subjected to general electrification is to take a deep breath and compose the nervous system to rest. The action of the current seizes upon and occupies the nerve forces, so that even in states of mental agitation when voluntary composure is impossible the mind is diverted and given tone.

With the deepening of respiration the force of the heart is energized and regulated, the internal and peripheral circulation is equalized, the general tone of the nervous and muscular systems is increased, combustion is carried forward, and increased appetite and capacity for digestion, exercise and sleep, together with a condition of marked physical refreshment, ensue upon repeated administrations.

The effect of each sitting, at first very temporary, reaches a maximum one or two hours after treatment and lasts a longer and longer time as improvement progresses. There is no reaction, no subsequent depression as from the use of drug

stimulants, and the action of positive electrification upon the system can best be compared to that of a substantial meal which produces its maximum effect, not at the moment it is eaten, but through subsequent processes of digestion and absorption. The nutritional effect of electric currents is as far removed from the popular idea of "stimulation" as is a hearty dinner from a glass of champagne.

Faradic Applications in Diseases of the Chest. — For sedative-tonic and vaso-motor effects, adjunct to other methods of treatment and the usual medical prescribing, it is not necessary to follow differential diagnoses, but the following affections may all be treated upon one general plan:

Capillary bronchitis, any form of bronchitis, phthisis, especially in the early stage, pneumonia, functional heart derangements, pleurodynia and all muscular rheumatism.

Moisten a felt or sponge covered, flat electrode about the size of the palm, connect it with the negative pole of the induction coil apparatus and apply it upon the back of the neck. With a sponge-covered hand electrode moistened in hot water, lubricated with a little soap and connected with the positive pole, make a labile application over the chest and trunk with the rapidly interrupted induction coil current adjusted to the comfort of the patient.

Possessing the superior facilities of static electricity in my own office practice I have no occasion to employ such a method, but in family practice a portable coil battery can be employed whenever it is desired to do so. As a matter of fact few physicians make any use of electrical currents at the bedside in cases in which familiar prescribing answers the purpose, and when drugs fail in such diseases as pneumonia it is by no means certain that electricity in any form would do more than relieve pain and symptoms, although a number of physicians hold to the opinion that many acute diseases can be successfully treated by electricity alone. I have had no personal experience in such cases, nor do I think that they will ever furnish a prominent field for practical electro-therapeutics.

In many exceptional cases individual physicians will obtain excellent results by methods with which they are most familiar, but the best work of medical electricity will always be done in the office or sanitarium.

CHAPTER LV.

TREATMENT OF CARDIAC AFFECTIONS.

Functional Heart Derangements. The Treatment of Chronic Heart Diseases.

Functional Heart Derangements.—So far as these are caused by other conditions which are satisfactorily treated by medication there will be little occasion to employ any form of electricity in their treatment.

To relieve the patient's anxiety, however, to restore the nervous tone and assist in transforming irregularity of the cardiac function into a normal process, general positive static electrification will always be useful and possesses a definite value.

If the case is recent and due to a temporary disturbance, one, two, or three applications will be found sufficient.

If the patient is anæmic, debilitated, or in any chronic condition which deters the heart from normal action, such patients can be benefitted in so many ways by static electricity repeated three or four times a week for a couple of months that it is good practice to employ it.

If palpitation and irregularity are caused by acute dyspeptic states, other measures are of course simpler and less expensive

to employ, and as they are entirely adequate I never suggest electricity to such a patient.

If chronic dyspepsia accompanies the cardiac disturbance, or causes it, the action of static electricity will be much less favorable when there is a low grade of catarrhal gastritis present than when the dyspepsia is of the nervous type. As a matter of fact, static electricity is apt to be disappointing in the treatment of many conditions of the digestive tract, and apart from the fact that it is less suited to some of these cases than others we encounter the additional difficulty of combating the aggravation caused by each of three meals a day by treatments which are seldom administered more than three times a week, while medical remedies are given after each meal.

If the cardiac neurosis is simply part of a general neurasthenia static electricity is the remedy *par excellence.*

The Treatment of Chronic Heart Diseases.—As a remedial agent with a marked tendency to regulate and sustain the normal functions of the body static electricity becomes one of the best of heart tonics and is probably the very best extra-drug therapeutic measure in both functional and organic diseases of the heart.

The following remarks refer to heart affections with cardiac inefficiency. The precise character of the lesion is of subordinate importance as compared with the fact of inefficiency or the liability of heart failure from lack of compensation. In order to bring out an appreciation of the full measure of value of static electricity in these cases the physician should carefully read the preceding chapter upon the actions of static currents within the living tissues and compare them with the following excellent summary of modern treatment by Satterthwaite.

There is a widespread and a growing interest in this matter (the treatment of chronic heart diseases), and I am firmly convinced from an investigation of it that we are able to do much more for these cases at the present time than we did a few years ago.

The older methods, as we all know, were, in the order of importance named, first, complete rest, venesection, and hydragogue

cathartics, followed by the usual heart tonics; and this antiquated system in the above order of values has been advocated in one of the latest American books on the practice of medicine.

I admit that there is a positive advantage to the wearied heart from the absolute rest from toil or worry that comes from a complete suspension of bodily or even mental activity; and that a certain amount of rest in bed may be desirable occasionally and for brief periods. But any improvement gained by this treatment soon ceases unless the enforced rest is supplemented by some activity of the muscular system, whether active or passive; or some additional relief for the overloaded heart by the use of one or other of the numerous remedial agencies we have at our command. Treatment by venesection and the old-fashioned hydragogue cathartics we need hardly allude to. The former, as will be generally admitted, has had its day; while the latter are certainly and rapidly being replaced by other remedies that are both efficacious and more agreeable to our patients.

Next in order I will speak of *diet*. I feel that this is a most important topic. In many of these chronic cardiac cases I agree with Grainger Stewart, who has recently reviewed the new methods of treatment in cardiac diseases, that the nitrogenous food should be increased, while the carbohydrates should be reduced; but I do so for two reasons. First, that a less amount of food is required by the body; and second, that by diminishing the carbohydrates we lessen fermentation, and so reduce to some extent gaseous distention of the stomach and its necessary result, pressure on an already distended heart. But I am opposed to in any great measure restricting the use of the carbohydrates, because they are needed to supply energy to the system. With these qualifications as to the kind of food, it will be seen that I favor a *mixed diet*. It is common to advocate a diminished use of liquids, but in many cases, as when lithæmia is associated with cardiac disease, there is an excess of uric acid found in the secretions. In these cases I advocate liberal potations of fluid. Chemistry teaches us that uric acid is readily dissolved in water, and practical experience shows us also that lithæmia is also greatly benefited by this liquid. Hence I favor the free use of water and am opposed to the so-called *dry-diet* system; but I do not advocate taking large quantities of fluid with the meals. Fluids should, in these cases, be taken between meals, if a large amount is to be taken. Where it is practical, diffusible stimulants, as, for example the aromatic spirits of ammonia, may be substituted with benefit for alcoholics. Tobacco, coffee, and tea, as a rule, are to be prohibited, and yet there are notable exceptions as to coffee and tea. Sometimes coffee is so great an aid to stomach

digestion that it is almost indispensable. Tea, if taken, should be weak. In these matters experience, skill, intelligence, and tact on the part of the physician are of the very first importance.

Next in order, in my opinion, come *regulated exercises.* It may be remembered that these were hinted at by Stokes some forty years ago, but he did not appreciate their real value, and did not systematize them. Of first importance are the modern systematic resisted movements, and are associated with the name of the Schott brothers, of Nauheim, in Germany. It appears that these men, while treating neurasthenics, found that in forcing the blood to the nerve centres, the volume of the pulse was increased, while at the same time its rate was diminished. As this result was desirable when treating loss of compensation in heart disease, they applied the method in these chronic cases with such satisfactory results that they have been recognized and employed by many of the practitioners of Europe.

In all, there are three classes of exercises practised by the advocates of movement. First in the severer cases, as in dropsy, or in very feeble patients, there are passive movements and also resisted movements by the physician or operator, who may also employ light but not deep massage. Second, there are slow voluntary movements of the patient resisted by the operator. Third and last, there is the Oertel treatment or some modification of it, an elaboration of Stokes' idea—the so-called mountain-climbing method.

In the Schott system, the exercises are all extremely gentle; the physician or his assistant always stopping short (in the movements) of any weariness on the part of the patient, and its resultant rapid breathing or increased rapidity of the pulse. If either of these undesirable phenomena occur, the exercises are immediately suspended and the patient is made to rest; and in any case, after each variety of movement there is always a breathing spell. The attendant never grasps the part with force, but with some firmness, and supports the patient with both hands while he resists each movement, and he always restores the limb to its original position, whether the patient is standing, sitting, or lying down. Both hands of the operator are always needed to give the movements in the manner most agreeable; meanwhile the patient is instructed to breathe naturally. If there is any paleness of the alæ nasi, the movements are at once arrested. A fundamental principle underlying this treatment is that each muscle of the body is to be made to work with a gradually increasing force, continuing to the close of the treatment. The movements are simple in character, being flexion, extension, abduction, and rotation, applied as nearly as may be to the limbs, neck, and trunk. The experience and intelligence

of the physician are naturally of vast importance if the treatment is to be successfully carried out in each case. It is not a routine method.

After each *séance* the heart is examined and also the pulse. Usually the heart is improved in action and with it the pulse, and the heart is more or less contracted. During a complete course these changes are at first more or less evanescent, but finally become more permanent. The patients also express themselves as feeling better, or else there is some improvement noted in the physical signs. The *rationale* of successful treatment is explained in various ways, but it is generally believed that the muscles during these movements, constituting as they do from one-half to one-third of the weight of the body, empty the veins and lymphatics during contraction, and in so doing diminish the peripheral resistance, as it is called, so that the arteries, which are not squeezed by the contraction of the muscles, have less resistance, and can therefore carry the arterial blood in them with great ease and completeness to the periphery. After a variable time, however, following each *séance*, the venous blood and lymph flow back again to the periphery and again the heart is in labor. But it has already gained some relief, and after every successive day of treatment it is apt to gain steadily in tone. The resisted movements are designed to produce tonic contraction of the muscles just short of producing a sensation of weariness in the patient. It will be seen that this method is best adapted for cases that still have a fair amount of cardiac tone remaining.

Most or all of these plans are modifications of the Schott method.

The Oertel plan is for the patient to climb hills, increasing the distances gradually. At Nauheim these distances are marked by guide-boards (*Terrain cur*). This method is certainly not applicable in severe cases, for the patient must have considerable strength in the cardiac muscle to attempt it. Accordingly, it plays an inferior rôle in heart treatment. Sometimes these various plans are more or less modified, but, on the whole, the Schott treatment has met with the most favor and appears to have given the best results.

Next comes the *treatment by baths*. In this plan the patient is immersed in a bath of warm salt water that has been carbonated. The effects of these baths, in my experience, are much the same in quality as the exercises, but on the whole they are less efficient. In the case of a young girl with a dilated heart, the result of congenital disease, I examined the apex beat with the finger before the bath and then after it, and found that the apex receded toward the median line fully three-quarters of an inch. while the pulse fell

from 124 before the bath to 100 five minutes after the bath. Meantime the pulse increased in strength. The bath lasted four and a half minutes. The system adopted in these cases is as follows, usually: After a variable period of rest, before beginning the course in severe cases, the patient is immersed in a warm and slightly saline effervescent bath; the duration of the immersion being from four to fifteen minutes, and the temperature 95°. Then, as the course proceeds, more and more salines are introduced, and more and more carbonic-acid gas. After every third bath or so there is an intermission of a day, and this period is taken by the physician to auscult and percuss and make such other examinations as are necessary. Assuming that a course lasts from four to eight weeks, while the potency of the bath is thus gradually increased, there is usually a coincident reduction in the temperature, which may be carried down to 85°, according to the capacity of the individual for agreeably sustaining such a fall of temperature. In feeble cases, where the cardiac tone has been lost, baths will restore it sooner than exercises. When, however, from any reason, baths cannot be employed, the method by exercises will produce satisfactory results, though a longer period will usually be needed.

The theory of these baths is uncertain. It has been claimed by some that the warm water relaxes the arterioles of the skin, and so overcomes the natural resistance, admitting of stronger and slower action by the heart. Others maintain that the action is reflex from the nerves of the skin to the arterioles of deeper parts. Others again have held that the effect is mental. According to Grainger Stewart's experiments, the effects are chiefly due to the carbonic-acid gas in the water. It numbs the skin. Stewart tried various kinds of warm baths, but the diminished area of cardiac dulness with improvement of the pulse only followed after the introduction of carbonic-acid gas into the bath. But both exercises and baths are only useful up to a certain point. After this point has been reached they are harmful. To make this treatment effectual, it is very important that the patient resume his work gradually, accustoming himself to it by slow degrees. Cases that are to be specially avoided in the treatment by exercises and baths are: acute heart affections of any kind; aneurisms, except in the very early stages; and arterial sclerosis, when it is well marked. To get the full benefit of this course of treatment the patient should follow it up by two or three weeks of rest at some climatic resort of medium altitude.

In conclusion, I will briefly review our medicinal remedies. Of these, digitalis still continues to stand at the head of the list, whatever theoretical objections may be urged against it in special cases.

Next in order comes, with a wide interval, strophanthus. It acts promptly, and is often useful in emergency cases, but is unreliable in action, and should not be continued for a long period. Caffeine is a safe and reliable remedy in many instances. In old cases of stiffened arteries, I have had great benefit from nitroglycerin, while iodide of sodium and iodide of potassium are valuable in many cases, because their use can be prolonged. They are especially serviceable in lithæmia. All cardiac tonics should be used cautiously in a fresh exacerbation, such as may occur in rheumatism. In this connection I should warn against the use of strychnine. In the neurotic forms of chronic functional disturbance, great benefit may be obtained from meals taken at short intervals. Bromides and other sedatives, or even preparations of opium, may also form essential parts of the treatment; but we may be able to succeed without them by the use of sulphonal or paraldehyde. Such has been my experience. Finally, arsenic and iron must not be forgotten as valuable adjuncts in certain classes of cases.

Apart from the beneficent action of general static electrification upon purely functional processes, the mechanical superiority of static massage or muscle-contracting applications for exercise, nutrition, and general muscular tone, to the crude and clumsy methods advocated by Oertel, Stokes, and Schott must be at once apparent to every one who is familiar with the best electrical methods.

The treatment by baths also possesses disadvantages as compared with static electricity. Both baths and exercises must be employed with a careful selection of cases and great care in the adaptation of treatment to each individual condition. They are tedious in detail, slow to act, and require to be kept up for a long period.

The *rationale* of successful treatment by these methods does not differ in any important way from the actions of appropriate static administrations. The greatest difference lies in the fact that with static electricity the patient may be treated by the physician himself without delegating any responsibility to either the patient or a third hand, and that: (1) the treatment is accomplished in ten or fifteen minutes with the patient seated in a comfortable chair and not subjected to any exposure;

(2) there is no removal of clothing; (3) the care in selection of cases is reduced to a minimum, for general electrification and its mild action in aid of the normal functions is suited to every case that can by any possibility come to the office—and local methods which may be superadded for symptomatic conditions are wholly devoid of danger in the hands of any physician who possesses ordinary skill in electro-therapeutics; (4) the benefits of treatment are more agreeably obtained, more quickly apparent, and are maintained at a point which keeps the patient comfortable with far less time and trouble than the Schott exercises.

When the patient is anæmic and weak and cannot get warm or keep warm, or has advanced to other marked disturbances of the circulation, the action of drugs and the precautions of hygiene may be efficiently aided by means of the static apparatus.

The following cases were reported by Caldwell:

Mr. G—— came to me with organic heart disease. Upon examination I found an enormously dilated heart, and he was suffering from all the aggravated symptoms that come with such a condition—shortness of breath, radial pulse very intermittent and irregular, cold extremities, and inability to lie down at all for fear of suffocation. Altogether, after finding out his true condition, I hesitated about giving him any treatment, fearing he might die some day in my office and it be said electricity had killed him. He was one of the first of such patients I had had an opportunity of trying the static current on, and I gave it cautiously, using the positive insulation for eight minutes three times a week. It had the effect of a heart tonic, strengthening and quieting its action. The pulse grew stronger and less intermitting, the breathing better, and at times he was able to lie down. While the patient was not cured, his last year was rendered much more comfortable by the treatment.

Rev. Mr. —— came to me suffering, he said, with heart disease. Palpitation, vertigo, irregular pulse, a great deal of occipital headache, with insomnia, were some of his symptoms, and he was greatly excited with the fear I would tell him he must die. Upon examination I found there was no organic lesion whatever; merely a functional condition due to mental overwork. The pulse would intermit about every fourth beat. In

this case I employed the negative insulation for ten minutes daily, and after the second treatment he was entirely relieved, as far as his "heart disease" was concerned. In two months' time discharged him cured.

Mr. W——, a young man, by trade a printer, came to me in a condition similar to second case, though more highly aggravated, and also suffering severely from dyspepsia, which caused a great deal of flatulence, especially at night, after dinner, when the fulness caused by it was very oppressive. His condition was induced by his running rapidly up seven flights of stairs to his business office rather than wait for the elevator, and he was in a very excitable, nervous state.

I gave him negative insulation five minutes, positive direct head breeze four, and positive direct breeze down the spine four minutes; treatment given three times a week.

The most aggravating heart symptoms were relieved at once and have never since returned, and the dyspepsia was speedily cured.

CHAPTER LVI.

BRIGHT'S DISEASES AND DIABETES.

Treatment of patients with chronic nephritis. Floating kidney. Relief of symptoms. Treatment of diabetes mellitus. Treatment of diabetes insipidus.

Bright's Disease.—I use the above term because it is familiar, and because it is entirely unnecessary for electrotherapeutists to attempt to discriminate between degrees of the pathological state. It is impossible for us to directly combat the inflammatory process within an inaccessible organ, but we can with more or less success improve the state of general health so that nature is aided in her "innate endeavor to restore the sound state." We can also relieve almost all the symptoms which distress the patient.

Whatever can be done with medical remedies at the same time should go hand in hand with the electrical portion of the treatment. Both the galvanic and faradic currents have been occasionally employed, generally passing them directly through the region in which each kidney is situated and sometimes supplemented by general faradization. To those possessing but partial resources in electrical apparatus these procedures are available. Speaking from some personal experience in the matter I can strongly recommend the following plan of treatment as an adjunct to medical and hygienic prescribing and believe the results to be better than are likely to be obtained by any other means.

Seat the patient upon the static platform connected with the positive pole. Ground the negative pole, and as usual devote the first sitting to making the patient familiar with simple general electrification and allaying any timidity which may have been in his or her mind.

Regulate the functions of the digestive tract and prescribe

for the patient in every way in which aid from drugs can be secured.

At the next sitting place the patient upon the static platform, connect it with the negative pole, ground the positive pole and the brass point electrode and apply a counter-irritant spray to the entire spine with special attention to the cervical and lumbar regions. If the patient complains of pain in any locality, or has other symptoms, attend to them by any indicated application, either sedative, nutritional, stimulating or counter-irritant.

Next ground the brass ball electrode and treat the entire surface of the liver, spleen, abdomen, spine and muscular portions of the lower extremities with rapidly applied frictional sparks. A quick operator will accomplish all this upon a patient who is once initiated to the methods in about five minutes. The headaches so frequent in these patients are wonderfully relieved by the counter-irritation at the base of the brain, but for further relief I next connect the head breeze electrode with the positive pole and administer a sedative breeze upon the vertex frontal region for several minutes, or until comfort is established.

During the first half-dozen sittings the greater part of the time may be consumed in dealing with special symptoms, but these will generally disappear, and thereafter I begin the sittings with the quickly applied counter-irritation over the spine, lumbar region, liver and abdomen, give a few mild sparks to the lower extremities, and then shift the platform rod to the positive pole and employ potential alternation for about fifteen minutes regularly.

It is important that sittings should be daily until marked improvement in the general health is established.

Both intrinsically and because of its great practical facility this method is among the most valuable of the resources of electro-therapeutics. The patient should in the future return from time to time for a short course of treatment whenever any decline in health is noticed.

I have nothing to say about the prospect of *curing* any of these advanced cases, but patients are often gratified by results which the theoretical therapeutist may regard as far from perfect. In practical medicine the circumstances under which chronic diseases are treated differ very materially from the picture of the diseases in text books, and radical cures do not figure so largely in the patient's mind as relief from pain and other distressing symptoms, and the ability to live with ordinary comfort.

In alternation occasionally with the static treatment may be employed a descending galvanic current through the entire spine.

Hart reports that in the treatment of nephritis he has placed a positive electrode to the back of the neck and a negative a little below the lumbar region and applied a constant galvanic current of from 10 to 15 mil. for half an hour, repeated three or four times a week. The results he reports were: Diuresis was increased, albuminuria diminished, disappearance of the œdema and uræmic symptoms.

Floating Kidney.—Palliative treatment for the relief of the nausea, pain and distress may be successfully applied when aggravations occur, and not only may the kidney be sometimes restored to its normal position but persistent treatment will prevent relapses from occurring so frequently. Either the hydro-electric douche method or an ordinary metallic electrode may be employed with the positive pole in either the rectum or vagina if the patient is also a case for uterine treatment.

Connect the rectal or vaginal electrode with the positive pole of the high-tension induction coil apparatus. Moisten a flat sponge-covered electrode about three inches in diameter, connect it with the negative pole and apply it over the region of the displaced kidney. Switch into circuit the 800 yard No. 32 secondary coil, the rapid vibrator and four cells. Gradually increase the current strength through the rheostat from zero up to the point of comfortable tolerance. Maintain the action for fifteen or twenty minutes. If applied daily for

a few times in conjunction with such other measures as may be indicated, the relief of symptoms will usually be complete for the time being. The continuation of the treatment regularly, at first every day and later three times a week, for a period of a month, will do much to increase the tonicity of the parts and lengthen the intervals between future displacements. A general nutritional benefit will also be experienced by the patient, and owing to the insurmountable objection which patients feel to radical surgery the palliative treatment is not without value.

A constant galvanic current of 20 to 25 mil. passed directly through the region (positive in front, negative behind the kidney) for a half-hour has been very grateful to one of my patients who has recurring pains deemed due to a floating kidney.

Diabetes Mellitus.—Seat the patient upon the static platform connected with the positive pole. Ground the negative pole and, as usual, devote the first sitting to making the patient familiar with simple general electrification and allaying any timidity which may have been in his or her mind.

Regulate the functions of the digestive tract and prescribe for the patient in every way in which aid from drugs can be secured.

At the next sitting place the patient upon the static platform, connect it with the negative pole, ground the positive pole and the brass point electrode and apply a counter-irritant spray to the entire spine, with special attention to the cervical and lumbar region.

If the patient complains of pain in any locality, or has other local symptoms, attend to them by any indicated application either sedative, nutritional, stimulating or counter-irritant. Next ground the brass ball electrode and treat the entire surface over the liver, spleen, abdomen, spine and muscular portions of the lower extremities with rapidly applied frictional sparks. A quick operator will accomplish all this upon any patient who is once initiated to the methods in about five minutes.

The headaches so frequent in these patients are wonderfully relieved by the counter-irritation at the base of the brain, but for further relief I next connect the head breeze electrode with the positive pole and administer a sedative breeze upon the vertex and frontal region for several minutes or until comfort is established.

During the first half-dozen sittings the greater part of the time may be consumed in dealing with special symptoms, but these will generally disappear, and I thereafter begin the sittings with the quickly applied counter-irritation over the spine, lumbar regions, liver and abdomen, give a few mild sparks to the lower extremities and then shift the platform rod to the positive pole and employ potential alternation for about fifteen minutes regularly.

It is important that sittings should be daily until marked improvement in the general health is established.

I know of no other therapeutic resource which is more satisfactory to the patient, especially as arbitrary restrictions upon diet need not be enforced.

Authors who confine their patients to the resources of galvanic and faradic currents advise the treatment of diabetes by central galvanization, general faradization, faradization and galvanization of the pneumogastric, galvanization of the sympathetic and of the brain and spinal cord, with experimental faradization of the liver.

While these measures have secured some favorable results, for they are valuable procedures, yet practically they are more troublesome than the simple and more effective method of employing a form of current which requires no disrobing of the patient and no troublesome technique.

Vigouroux recently reported the following case treated by him presumably by a method less thorough and efficient than the plan I have described.

I have had under observation a case of diabetes of great gravity, and with exceptionally high ratio of sugar and urine. The patient was a man thirty-eight years of age, suffering from

paraplegia and diabetes, whom I treated at Salpetrière eight years ago. The urine excreted in the twenty-four hours measured upward to 16 litres, and the quantity of sugar eliminated during the same time was 1,260 grams. After three months' treatment by static electricity, at the rate of three sittings per week, without any other treatment whatever, the paraplegia disappeared, the general condition and appearance of the patient had greatly improved, and the excretion of urine and sugar had fallen to four litres and 300 grams respectively, representing only one-fourth of the original amount. He had previously been treated by the usual methods without the slightest benefit.

Diabetes Insipidus.—Dr. C. P. B. Clubbe speaks of this method of treating diabetes in the London *Lancet*. He reports the case of a woman who passed from eighteen to twenty pints of urine per diem. It was light colored, very low specific gravity and contained no sugar. All drugs recommended for diabetes were tried, without result. She was then ordered electricity (faradism) to be applied over the region of her kidneys every day, for about twenty minutes at a time. Under this treatment the daily average amount of urine diminished during six weeks from 237 to 113 ounces; where it remained nearly stationary, varying but little. At the end of the twentieth week all treatment was discontinued. Six weeks afterward she was in about the same condition as when treatment was stopped. Dr. Clubbe thinks this result would justify the more extended use of this treatment in diabetes insipidus.

CHAPTER LVII.

STRANGULATED AND IRREDUCIBLE HERNIA.

Hernia.—Both the galvanic and rapidly interrupted high-tension induction coil currents have been successfully employed in emergencies to assist in the reduction of strangulated and irreducible hernia; the one for its osmotic action to reduce the fluids beneath the positive pole and the other for its powerful vaso-constrictor effects.

Galvanic.—Place the patient in a suitable position to aid in the process. Connect an ordinary rectal electrode with the negative pole and insert it deeply within the rectum, or employ a hand electrode on the surface near the tumor. Select a felt

Fig. 383. Rectal electrode, bare metal.

or sponge covered hand electrode of moderate size which will cover less than the area of the sac. Moisten it in a hot-water solution of bicarbonate of soda, connect it with the positive pole and apply it to the tumor. Gradually increase the constant galvanic current from zero up to 15 mil., and after two or three minutes again increase to the maximum of comfortable tolerance. Maintain the action of the current until a sufficient amount of the fluids and gases in the sac have been driven out by the push of the current to permit successful reduction in the usual manner.

Faradic.—Prepare and apply the electrodes in the same

manner as above described. Connect the external electrode with the positive pole of the improved induction coil apparatus. Switch into circuit the 800 yard No. 32 coil, combined with the short No. 21 wire coil, together with the rapid vibrator and four cells. Gradually increase the current strength through the rheostat from zero up to comfortable tolerance and maintain the action until the intestine recedes and reduction by taxis becomes possible.

One or the other of these methods has been reported successful when persistent efforts without the aid of the current have failed to reduce the tumor. They are always worth trying and are without harm, and if any inflammation is feared it is only necessary to switch the 1,500 yard No. 36 coil into the circuit after reduction and make a long-continued application of a sedative current.

While I am not aware of any systematic attempt to obtain a radical cure of hernia by strengthening the muscles, yet if any one wishes to try this plan of procedure it is perfectly simple and consists only in procuring slow contractions with the faradic current with the negative electrode upon the site

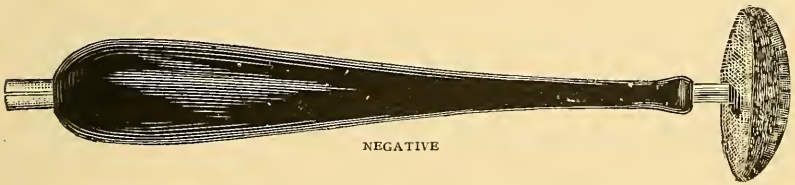


Fig. 384. Ordinary sponge-covered hand electrode.

of the lesion and the positive electrode at any convenient situation. Theoretically the purpose could be accomplished in recent cases, or, in fact, all ordinary cases of hernia in which it is expected that improvement will take place simply from wearing a truss. The slow processes of nature in strengthening the muscles ought to be materially assisted by daily applications of muscle-contracting currents in the same manner

employed in the treatment of paralysis. The truss could be continued as usual.

The deep-seated objection in the popular mind to a surgical operation would suggest the advisability of attempting to tone up the muscles, particularly in all recent cases and in the young.

One would suppose that there would be very little "new under the sun" in reference to the management of hernia. I should hesitate to add to the volumes written on that subject during the past half-dozen years were it not for the fact that I believe I have something both new and important to offer. It is to the management of recent strangulated and old irreducible hernia that I desire to direct attention.* I shall confine myself strictly and briefly to my own method of procedure, one which has given me considerable satisfaction, and which in strangulated cases has saved me much trouble, and the patient all risk of injury from taxis or operation.

Many a case of strangulated hernia has been sacrificed, either because of the inability or the disinclination of the physician in attendance to operate, or because no competent help was within reach. This, in my opinion, need not be, since the "operation" which I propose is simple and open to all. All that is necessary for the successful treatment of recent strangulated hernia is the possession of a fairly powerful (20–30 cell) galvanic battery.

The patient is first placed in the most convenient position for reduction, such as is generally advised in the employment of taxis, and medium size fine sponge electrodes, moistened in warm saline solution, are used. The positive is placed directly over the tumor, the negative within a couple of inches, when the current is turned on, gradually increasing its strength until as much as can be borne is passing. To measure the current is not necessary, although advisable. This should be passed steadily for from two to five minutes. On the removal of the electrodes, very gentle attempts at reduction should be made. If these are not always immediately successful, reapply the electrodes, and allow the current to pass as before. This should be repeated until reduction is easily effected. Taxis should be most gentle; no prolonged or rough handling is necessary. The following cases of mine will give an idea of the obtaining conditions and the results secured. I will state that in every case taxis was tried, both by myself and others,

* *Medical Record.*

and proved totally ineffective. The cases would have been given over to the surgeon's knife.

CASE 1.—Mrs. A. B., aged fifty-two, umbilical entero-epiplocele, size of a hen's egg, and existing for ten years, came to my office December 10, suffering from strangulation. Constriction moderately tight, tumor bluish; twenty-four hours' duration. Repeated attempts at reduction by taxis failed. Positive over tumor, negative two inches to the left of umbilicus, when three applications were made, lasting in all about fifteen minutes, and on removal of electrodes for the third time the hernia was reduced almost by touch.

CASE 2.—R. H. W., aged thirty-five, railroad official, complete oblique inguinal enterocele, six months' duration, came to me the evening of April 5, 1892. The constriction was very tight; duration of strangulation five or six hours; attempts at reduction by myself and others failed, the general opinion being that there was nothing left but to operate. Galvanism applied as described during five or six minutes, with three or four slight intermissions, was followed by reduction with very little effort.

CASE 3.—J. Z., aged twenty-seven, car carpenter, large scrotal enterocele of ten or more years' duration. Strangulated for about four hours; resisted all efforts at reduction by taxis, position, etc. In this case it was found necessary to continue the current, with numerous intermissions and constantly increasing strength, for fully half an hour. At each intermission gentle attempts at reduction were made, but half an hour elapsed before any apparent impression was made. Reduction was finally accomplished easily.

CASE 4.—One more case, and I am done with this subject. George L., two and a half years of age, neglected scrotal enterocele of two years' duration, was brought to my office May 15, 1892, with strangulated hernia. Duration of strangulation about ten hours; constriction very snug; tumor very tense. After etherization efforts were made by myself and others to effect reduction. Our efforts proved unavailing. One physician present remarked that he had assisted at an operation a few days before in a case identical, and expressed himself to the effect that an operation would be absolutely necessary. Anæsthesia was most profound; an extremely powerful current was run for (with intermissions) twelve to fifteen minutes, reduction then being fairly easy.

When the patient is very sensitive, or in the case of children, an anæsthetic is necessary.

My cases now number upward of twenty, and in none have I failed to reduce the hernia within from five to thirty minutes.

Of course it is understood that complicated cases may be met in which this treatment would not be successful, but fortunately they are very rare and need not be taken into account, as in the event of failure the operation may be done, no harm having resulted from treatment, and *no material delay occasioned.*

Irreducible Hernia.—In the treatment of old irreducible herniæ the usual conditions to be overcome are from the formation of adhesions, and, in utero-epiploceles and epiploceles, thickening and induration of the omentum. There are other rare causes for this irreducibility, as in a case upon which I recently operated, a congenital, complete oblique inguinal. Patient thirty-five years of age; tumor composed entirely of omentum, which was spread out fan-shape, base measuring six inches; apex at external ring one inch, which small portion completely filled both rings and canal, plugging them so well that, although the patient had never worn a truss, at no time had the intestines escaped, the rupture causing him no trouble or inconvenience, except through the large size of the scrotum. The irreducibility here was due to the disparity between the part to be returned and the openings through which it should pass, a condition that was unusual, as in most old irreducible herniæ of any size the canal is obliterated, or nearly so, the rings being approximated (the hernia direct) and widely dilated. It is to the ordinary forms of irreducible herniæ that my method is applicable, and in which it has been successful in nearly half a hundred cases. In fact, unsuccessful in only three—one an enormous scrotal entero-epiplocele, scrotum measuring twenty-six inches at junction with the body, and twenty-eight inches from side to side in line of raphe, irreducible over twenty years. Before reduction had been accomplished a violent effort on the part of the patient caused strangulation. The surgeon who saw him, and who operated, informed me that he found no adhesions, nor any other apparent cause for irreducibility. The other cases were quite similar, both becoming strangulated. An operation was deemed necessary, and as the patients lived at a distance, I did not see them, nor did I operate. The time usually necessary, according to my experience, to effect reduction, is from one week to one month. In one case over two months was occupied; this was an enormous scrotal entero-epiplocele, irreducible for twenty-one years. As in this case, it is often impossible to reduce the sac—but that is of small account—as a truss can be worn just as well, though the sac remain permanently down. The after-treatment of such cases will be reserved for a future article. The time required to effect reduction depends somewhat upon the nature of the case. Enteroceles yield quite quickly, as a rule; entero-epiploceles and epiploceles require much longer time.

For the successful treatment of irreducible hernia a galvanic battery and small sponge electrodes are required. A milliamperemeter is not absolutely necessary, though for many reasons advisable, the gauge for current strength being what the patient can possibly bear. If scrotal, the current is passed directly through the hernial tumor. When this becomes too painful positive anode is used on scrotum, moving it about from place to place; negative at junction of scrotum with body. In incomplete inguinal, femoral or umbilical, the positive is placed directly over tumor, negative very near by, the object being to get the polar effect as much as possible. The time occupied in a single sitting should not exceed fifteen minutes, interrupting frequently, care being taken to have the current traverse every portion of the tumor. After each treatment attempts at reduction should be made, the tumor being not too forcibly kneaded and manipulated, in order to assist in breaking up any adhesions that may have been weakened or partially destroyed by the current. The following will illustrate the average run of cases, as I have found them:

CASE 5.—Lewis P., aged fifty-six, undertaker, large scrotal entero-epiplocele, irreducible ten years, in size, as he expressed it, "as large as the hub of a lumber wagon, nearly as hard and tense." Numerous attempts at reduction had been made by different surgeons. I first saw him January 16, 1888, when treatment was begun. He was a good soldier, and stood an exceedingly hot current without complaint. January 21, 1888, after the fourth treatment, reduction was accomplished with the greatest ease, the necessary manipulations taking not over a minute or two.

CASE 6.—J. W. S., aged sixty-five, merchant, complete oblique inguinal enterocele, size of hen's egg, irreducible ten years; has suffered very much, being obliged to wear a hard, slightly convex truss-pad, with considerable pressure over the tumor to prevent strangulation, which had occurred several times when attempting the use of a concave pad, or to go without any. Being a gentleman of wealth, he had consulted many prominent surgeons. No hope of relief was offered except through an operation. He consulted me June 2, 1889. Treatment was at once begun, and repeated every other day. On July 1, 1889, reduction was accomplished, and a truss applied, which is worn with comfort.

CASE 7.—John W., aged twenty-six, railroad engineer, scrotal entero-epiplocele, irreducible three years. Tumor the size of a goose egg. Began treatment March 1, 1891; daily applications. March 16, 1891, reduction effected. Mr. W. had consulted several physicians before coming to me, among them

an emeritus professor of surgery, the unanimous opinion being that an operation was demanded, on account of the liability of strangulation, owing to the nature of his occupation, and to the fact that he was on his engine away from home, out of the reach of aid most of the time, and could wear nothing in the way of protection.

CASE 8.—L. W. M., aged thirty-two, bookkeeper, very large scrotal entero-epiplocele, scrotum measuring fourteen inches in circumference, irreducible twenty years. Many attempts at reduction had been made. Consulted me January 10, 1892. Treatment began and repeated every second to third day. In about four weeks the intestine was reduced, the large mass of omentum going slowly. There is a question in this case—if there is not still some omentum down, the scrotal tissues are very much thickened, the sac is surely down and thickened—but I cannot satisfactorily determine the presence of omentum. If there is any it is very little. One reason for feeling that there is no omentum left is that he has worn a truss with convex pad continually for several months without discomfort, which would not likely be the case were omentum present and pressed upon by the truss-pad.

CASE 9.—John S., aged fifty-eight, brewer, large scrotal entero-epiplocele, fifteen years' duration, irreducible eight years. Began treatment August 1, 1889; treated every second to third day; reduction accomplished September 3, 1889, and a truss applied which was worn with comfort till his death, which occurred from Bright's disease, about one year later. (*Marcley.*)

CHAPTER LVIII.

ELECTRIC CURRENTS IN ORTHOPEDICS AND FRACTURES.

Orthopedic diseases improvable by electricity. Faradic currents in fractures. Fibrous ankylosis of joints. Lateral curvature of the spine.

Electric Currents in Orthopedics.—The following abstract of a paper by a prominent surgeon of New York will present the general aspect of this subject.

The action of electricity in orthopedics must, as in every other department of medicine and surgery, consist in change in the nutrition of the part. This change must consist either in reduction of nutrition where it exists in an exaggerated form (as in inflammation) or in an increase of nutrition where it is lacking or deficient (as in paralysis).

Outside of the operative and mechanical measures employed by the orthopedist electricity holds the most important place in the treatment of the diseases coming under his care. Among the conditions requiring electrical treatment as essential to cure may be mentioned the various forms of talipses, as equinus, calcaneus, varus, valgus, cavus, and their combinations—flat foot, knock-knee, toeing in, weakness of various muscles (especially the quadriceps extensor), torticollis, wrist drop, fibrous anchylosis and chronic arthritis.

Most, if not all, of the above-mentioned conditions I have seen improved, and many of them cured, with the help of electricity, and some of them by electricity alone. In many cases the electricity may be called the principal agent, and this may be especially true in the cases of paralyzed muscles, while the braces, massage, application of heat, etc., act as auxiliaries.

No class of cases is more trying to the surgeon and patient than those termed orthopedic, for several reasons. The time required in the treatment of these cases is long, for progress as a rule is slow. This necessitates expense. Another and

still more important difficulty is the fact that most of the patients are children, and children as a rule do not take much interest in the relief of any condition that does not give them pain. Consequently, it depends upon the enthusiasm of the doctor and the perseverance and patience of the parent to carry the case to a successful issue. This is especially true where electrical treatment must extend over a long period of time, but all this patience, perseverance and enthusiasm pays in the end.

In a paper before the Bureau of Pediatrics at the medical congress last spring I tried to set forth the importance of attending closely to an apparently unimportant class of cases. These cases are young children who walk awkwardly with a shambling gait, but who apparently have no especial lesion or deformity.

For the reason that there is apparently no serious disease the parents are apt to attribute the awkwardness to carelessness on the part of the child. If these cases are investigated and the muscles carefully tested it will be found that there is an unequal balance of muscular power. I know one case of a young lady who never knew what was the matter with one of her feet and limbs and who was of rather a moody and melancholy disposition; the trouble was that she had talipes cavus with weakness of the peroneal muscles and the anterior muscles of the thigh.

Under careful electrical treatment the foot not only resumed its normal shape and the muscles became strong, but her disposition changed greatly for the better. Electricity is one of the most powerful agents for good in educated and skilful hands. (*Wilcox.*)

I can corroborate the statement that in these cases the greatest result, not only physical but mental, has followed electrical treatment. Patients are a great deal stronger and healthier after treatment. Where they were weakly, catching cold easily before; where they had no appetite, and were very irritable; I have seen the greatest improvement by balancing up as it were these muscles. I have also noticed the greatest improvement in the mental condition; and in fact I think the improvement in the mental condition is even greater than in the physical. This girl that Dr. Wilcox speaks of, instead of being morose and melancholy as she was before, became bright and happy. She was under treatment about three months. She told me that she had had more happiness the last winter than in ten years before. I have also noticed in children that did not get along well in school—and it was almost impossible

to get them to go to school, for they got along so badly with their studies that they did not like to go—I have noticed an improvement so that they liked to go to school and study and presented the greatest improvement in their whole mental condition. (*King.*)

Faradic Currents in Fractures, Simple or Compound, with or without Luxations.—For over ten years I have employed faradic electricity in reducing inflammatory swelling, œdema and pain; it lessens the shock to the system and prevents tetanus. In compound fracture the wound heals promptly and without the suppuration which makes this class of fractures so redoubtable an injury.

To a great extent it prevents the swelling and stiffness following disuse of the limb.

Fractures of the Leg.—After bandaging, I place negative at the foot, and pass the current from the hip or any part above the injury, taking the anode electrode in my one hand and applying with the other hand over and around the limb; current pleasant to the patient; fifteen to twenty minutes daily. If there has been dislocation, treat all around the joint, always dampening the bandage sufficiently for the current to penetrate, or apply before rebandaging.

Fracture of the Arm at any Point.—I place negative on spine about fourth dorsal vertebra, and commence treating from the hand upward; and when the fracture implicates the joints, I treat these parts by passing the current through the joint—cathode, stabile current, anode, labile current. I use anode pole in all these treatments as directed for fracture of the leg. (*Flinn.*)

Fibrous Ankylosis of Joints.—Select two similar felt or

Fig. 385. Felt or sponge covered flat electrode, assorted sizes.

sponge covered electrodes adapted to the particular joint. Moisten them thoroughly in hot water containing one or two per cent. of bicarbonate of soda and connect them to the terminals of the galvanic battery. Place one upon one side of the joint and the other opposite. Gradually increase the constant galvanic current from zero up to the maximum tolerance of the tissues.

In small joints this may be perhaps 20 mil., but in large joints where large electrodes can be employed the amperage may range from 50 to 100 mil. according to the state of the skin. After about fifteen minutes reduce the current to nearly zero, switch the interrupter into circuit and again increase the current until it produces strong pulsations through the joints. In about five minutes reduce to zero. After removing the electrodes dust the skin with antiseptic powder, and throughout the treatment use all precautions to keep this important conducting medium in good order. Repeat every second day until benefit ceases.

The benefit may be increased by exercise of the muscles about the joints by means of either static sparks or the slowly interrupted induction coil current. The benefits which result are an increase of motion, cure of pain, reduction of the swelling, improvement of circulation and increased general usefulness of the limb. The best results are obtained in cases of injury, and the shorter the interval before treatment is begun the more rapid and the greater the improvement. It should be begun immediately upon removal of dressings in all surgical cases.

Lateral Curvature of the Spine in Adolescents.—Remove entire garments down to the hips and place the patient face downward upon the operating table or couch. Under the abdomen place a felt-covered, flat electrode, about 6 × 8, connected with the positive pole of the high-tension induction coil apparatus.

Connect with the negative pole a medium sponge-covered hand electrode moistened in hot water and lubricate it with

a little soap. Apply this electrode upon the back of the neck while regulating the current strength.

Switch into circuit the combined 21 wire and the 800 yard No. 32 coil, rapid vibrator and four cells. Through the secondary fluid rheostat increase the current strength from zero until it creates a sensation of warmth and a decided but agreeable grasp upon the tissues.

Pass the negative electrode slowly down the entire course of the spine and observe the sensation. If the current is not perceptible at all points it should be increased. If it detects points of tenderness (and these are very common between the shoulders and in the lumbar region), the electrode should be held stationary over each tender region, the current regulated to the maximum of tolerance and maintained until complete sedation is effected. This will require only one or two minutes as a rule for each tender area.

Having prepared the tolerance of the spine for a somewhat stronger current again adjust the dose and make a labile application up and down the spine and over the muscles of each side of the back for about five minutes. As the electrode passes over the motor points it will cause muscular contractions of a kind which possess great nutritional value. These should be made vigorous but entirely agreeable; with the author's coil apparatus very powerful contractions are *painless.*

Next move the switch arm from the rapid to the slow vibrator and increase the current until vigorous contractions at the rate of about 70 per minute are produced. Exercise in this way all the deficient muscles, beginning with a few contractions at the first sitting and gradually increasing as strength and endurance develop. Always stop short of causing fatigue.

Close each *séance* of ten or fifteen minutes with a brisk rubbing of the spine with a moderately coarse towel. The refreshing effect of this application renders it especially grateful to patients. Repeat according to circumstances, daily or every second day at first, and later three times a week.

Omit the application during menstrual periods if the patient is a girl and has matured. Omit also all artificial support, but advise outdoor exercise with crutches and the bicycle, both of which are equilateral muscle and health developers of the first order. Crutches particularly are an invaluable aid in restoring bilateral uniformity to the muscles, and owing to their inexpensive cost and feasibility they can be employed in every case even when the child has not yet learned the art of cycling.

Leyden-jar currents can be employed in the same manner, and the aid of general static electrification will often be important in promoting the general health.

CHAPTER LIX.

TREATMENT OF LOCOMOTOR ATAXIA.

Uses of static electricity. Uses of galvanic currents. Treatment for different stages of the disease. Cases illustrating special galvanic methods.

Locomotor Ataxia.—Static electricity can hardly be said to treat locomotor ataxia. *It is, however, of great efficiency in the treatment of a patient who has this disease.*

I believe it to be of much greater efficiency than writers accord it, but I refer to static electricity as a whole, with *all its therapeutic and physiological resources*, in the hands of one who applies it according to its indications, instead of the perfunctory routine of static sparks.

If the possessor of every Holtz apparatus in this country was properly instructed in the technique of static administrations and exercised reasonable judgment in considering the indications for different methods, it is probable that many more cases of locomotor ataxia would receive substantial instead of merely temporary benefits.

In order of importance the treatment of this disease is based upon the following measures: "(1) Rest; (2) nutrition; (3) removal of reflex disturbances; (4) drugs directed against the lesion."

Static electricity comes very near to covering the last three

of these indications, except so far as specific medication may be required for a specific cause of the sclerosis. I leave to others, however, the theoretical discussion of how best to "cure" this frequent disease of the spine, and will simply state the manner in which I treat patients who come to me suffering from locomotor ataxia.

Most of the patients who finally reach the office of the electrotherapeutist are somewhat advanced in ataxia and have already decided that medical treatment could not cure them.

If there is no specific history there is almost no occasion to prescribe other drugs, and I depend entirely upon galvanic and static treatment, with ordinary personal hygiene. It appears probable that at some stage of the processes within the spinal cord the galvanic current may accomplish what static electricity certainly will not; but it is hard to decide what goes on in the spinal cord.

For the relief of symptoms, and local and general nutritional effects, my main dependence is static electricity, and patients learn to look to it with more confidence than to any other form of treatment they have ever received.

It may be said in passing that the clinical history of some ataxic patients shows a wide range of experience in the hands of different neurologists, and some of them become very expert in deciding what makes them feel better. It is very rare to find an exception to the rule that static electricity holds the first place in their affections.

Omitting references to methods of applying other currents I will proceed to static electricity, and say that there is no stage of the disease in which it is contraindicated, or in which it cannot contribute something to the patient's comfort. Although I follow no routine, but meet the condition which each patient presents as seems to be indicated at the time, it is necessary to write of the matter in some systematic way, even if this involves arbitrary division of the disease into theoretical stages.

Whatever symptoms present themselves in the first stage of locomotor ataxia, which is presumably limited to congestion and other changes which precede the sclerosis, they should be treated upon the same principle that the same symptoms would be treated in any case not locomotor ataxia. The spine is not to be thumped indiscriminately with powerful static sparks because the diagnosis points to this disease.

One of the best methods of treating congestion and advancing stages of inflammation is the sedative spray. Peripheral applications of the spray, mingled with mild sparks from the brass point electrode, will do a great deal to relieve pains which are associated with conditions which call for sedation rather than the mechanical violence of the percussive spark.

It is in more advanced conditions of sclerosis that sparks to the spine are indicated, but the whole treatment of locomotor ataxia with static electricity practically resolves itself into treatment of symptoms and endeavors to maintain functional processes and nutrition.

A promise to cure the disease must be left entirely out of the question; but in saying this I do not mean to imply that any other agent administered for the same ends would accomplish more. *Posture during treatment is important.*

It naturally follows that the operator who expects to produce satisfactory results with this class of cases must understand all forms of technique and know when to apply them.

When the spinal condition is recent and requires sedation the breeze is indicated. When it is chronic and needs stimulation, a stimulating breeze, spray, and spark present different modifications for use. If the head aches, the positive breeze will remove it. When the organs of the trunk are severally involved, the same principle of spray sedation (if muscular soreness, tenderness, or other signs contra-indicate the spark) applies to them; while if the condition is chronic and needs stimulation the spark is well tolerated and beneficial.

Some patients have scarcely any pain at all, and some find

pains their chief trouble. If these pains are burning and throbbing and originate at any definite point, I concentrate a good deal of spray in the indicated locality before using sparks. If the pains shoot from place to place and have no settled habitation, their relief goes along with the general nutritional treatment which is the main part of every sitting.

This treatment embraces the whole nutritional resources of static electricity as described on another page, with the particular addition of an extraordinary number of sparks upon areas of numbness, pain, or anæsthesia, including the soles of the feet.

What would be intolerable to an ordinary patient will only initiate an agreeable sensation to the ataxic individual, whose legs below the knees are heavy and numb.

It is considerate, in all cases, to begin every powerful spark treatment with a preliminary warming up with milder measures, for when the circulation is well established and the patient composed by a few minutes' rest on the platform he will be better prepared for energetic measures.

In every case it is my custom to advance to powerful sparks only after the tentative employment of milder measures, and by this plan I am enabled to say that I have never aggravated the symptoms, irritated the patient, or made him less comfortable.

On the contrary, it is the rule that the patient sleeps better, feels a decidedly beneficial muscular reaction and steadiness, maintains a greater degree of comfort, and does not appear to go down hill so rapidly; he is inclined to think that static does him more good than anything else he has ever tried; he may even for an indefinite time improve; the process may seem to be arrested; he may seem to be cured; in some cases he is finally able to go entirely without treatment for several months or even a few years; in other cases he is only able to keep fairly comfortable when he takes static regularly at greater or less intervals, sometimes once a week, sometimes twice or three times a week.

In other cases (and these are a small minority) the patient is a negative sort of individual who thinks nothing ever does him any good, and after a little while he drops static also.

The effects of specific medication are too well known to need mention here. One of the chief difficulties in estimating the value of static electricity in chronic cases of this character is the fact that patients are often treated at wholly inadequate intervals, with more or less irregularity, and sometimes by inadequate operative skill. Nine-tenths of all that appears in medical literature about either the uses or limited value of static electricity in locomotor ataxia may be rejected by the physician of to-day who possesses an improved Holtz machine and who knows how to use it.

I will now consider the uses of the constant galvanic current in locomotor ataxia.

Among the variety of methods by which the galvanic current has been employed, the following is perhaps as satisfactory as any.

Moisten two felt-covered, flat electrodes, about 4×6, in a one

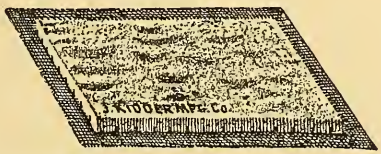


Fig. 386. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

per cent. hot-water solution of bicarbonate of soda. Connect one with the negative pole of the galvanic apparatus and apply it to the cervical spine. Connect the other with the positive pole and place it beneath the lumbo-sacral region. Gradually increase the constant galvanic current from zero up to 15 or 20 mil. In fifteen minutes reduce to zero and shift the positive electrode to the abdomen.

The balance of the treatment can be given in either of two ways. The patient may sit upon a stool while a sponge-covered negative electrode is promenaded up and down the

back, or he may recline in the dorsal position upon a felt-covered spinal electrode three inches wide by from twelve to eighteen inches long. In either case a mild dosage is sufficient, and if one polarity upon the spine does not afford relief try the other, for the condition of the patient rather than the

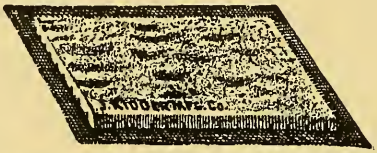


Fig. 387. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

name of the disease points to the selection of the pole. The galvanic current is most useful in the first and second stages of the disease before the ataxia is advanced and when there are no complications of the bladder and other organs.

I insert the following clinical cases to illustrate special methods employed by others:

CASE I. J. H., aged 42. Locomotive engineer, admitted to hospital twelve years ago with locomotor ataxia. Could scarcely walk with eyes open and could neither stand nor sit steadily with eyes closed; no response of reflexes; perfect anæsthesia below the knees; mind occupied constantly with delusions, recognizing members of his family as embodiments of stranger spirits.

At the end of three months' treatment consisting chiefly of galvanism he had some knee-jerk and some sensation of legs and feet, and his mind though occupied by some harmless spiritual delusions was practically restored to usefulness and he was discharged, but not to resume his former occupation. He however was considered well enough to return to his engine and did so, working for six months, when one day he ran down a tramp on a trestle and killed him.

He was readmitted to hospital in about the same condition as upon first entry, though his mind was even more disturbed. He was treated again in the same way as before for two months and was again discharged as able to work and as fully recovered as at time of previous discharge. Since then he has again worked steadily as a machinist. I saw him a few weeks

ago. He has again lost the knee-jerk; has lately suffered from numbness of the feet; his mind is slightly perturbed and he has become somewhat deaf, but is still able to do good work.

Method.—I used a mild, stabile, galvanic current; one electrode at feet, the other—three inches wide by one foot long

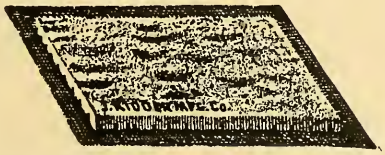


Fig. 388. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

—over upper part of spine; *séance* ten minutes daily; direction of current chiefly upward, though reversed to downward direction once or twice during *séance* yet always finishing with the ascending current.

This is my usual treatment in cases of this class modified more or less as to the number of reversals; frequently reversing about every two minutes, but finishing usually with the ascending current; also occasionally modified by labile treatment of the spine and incidentally to other parts of the back, pausing for an instant, especially when handling the positive electrode, at tender or painful points. Occasionally the foregoing practice is modified by placing the upper electrode in the patient's hands. This I believe to be good practice, for in such cases the functions of the upper extremities as well as of the lower are frequently at fault and stabile electricity at hands and feet meet special indications here besides causing such extensive diffusion of the current through the body as to meet most other indications, though the special application over the spine and particularly over affected areas may be of great utility. In the matter of reversal of currents the current should be reduced to zero before changing the polarity, and the dosage gradually turned on again.

No definite rule as to strength of current can be laid down for the treatment of this class of cases. The state of the skin affects the tolerance and this must be considered; in general the doses will run below 30 mil., sometimes down to 5 or 10 mil.

At the beginning of treatment daily *séances* are usually in order so that the effect shall be maintained, but after marked signs of improvement—in from one to two weeks—the *séances*

are gradually reduced from six to five, four and finally only three sittings per week.

CASE 2. LOCOMOTOR ATAXIA FROM DIPHTHERIA.—In 1886, I treated the six-year-old son of S. G. for locomotor ataxia, resulting from a protracted, severe attack of diphtheria. He could not walk even with his eyes open without falling, and had returned to creeping. The reflexes at soles and knees were entirely abolished, and he had aphonia. I called in consultation the ablest neurologist on the Pacific Coast, who agreed with me as to the probable utility of electricity, but he advised the faradic current to be applied to the neck and the galvanic current to the spine, and expressed the opinion that direction of the current was immaterial. The patient's temperature was 96.5. I commenced the treatment as suggested, giving daily *séances*—applied the faradic current to the neck, about as strong as the patient could bear, for five minutes, and with electrodes at the feet and spine gave a stabile, downward, galvanic current of 10 ma., delivered by switch, for ten minutes. This treatment was continued for a week, when patient had not only not improved but was rather worse in every respect. I then discontinued the faradic current and applied the galvanic current in an upward direction, but in other respects precisely as before—same strength of current, same time, etc. At the end of the second week there was some improvement; the voice had increased from a low to a husky whisper, and patient could stand a little longer on his feet; his temperature has risen to 97.3—nearly a degree, but there was not the slightest response of reflex tendons. This treatment, namely, the ascending current was continued, though the strength of current was lowered to 6 ma., and the length of *séance* reduced to eight minutes. At the end of the fourth week the patient was nearly well, though the knee-jerk was still only just perceptible. The temperature had become normal; the voice had returned, though was yet somewhat weak; and he could walk about for a half-hour without assistance. Treatment was continued, though only three times a week, for another month, when patient had fully recovered in every respect. He is now alive and well.

CASE 3. LOCOMOTOR ATAXIA FROM TOBACCO.—In 1886, J.F., 38, laborer, admitted to hospital on account of locomotor ataxia. He could not stand or even sit erect with his eyes closed, and staggered like one intoxicated when walking with eyes open. Patellar reflexes absent and no response at soles; skin generally more or less anæsthetic—did not feel ordinary pin pricking even at arms or neck or face, nor deep pin pricking at lower extremities; mind not impaired, but speech sluggish.

Cause of ataxia seemed to be from excessive use of tobacco. Gave stabile current of 20 ma., delivered by switch to foot and spine electrodes, ten minutes daily; and for three consecutive days, experimentally in a descending direction, with the effect of aggravating the symptoms. Then I administered the same current in an ascending direction and the patient at once—during and immediately after the *séance*—expressed himself as feeling better and his voice was stronger and he looked brighter. This treatment was persisted in daily except Sundays, and there was daily improvement; sensation and activity of reflexes gradually returned and the ataxia gradually disappeared and he was discharged fully recovered at the end of three weeks' treatment, and has since remained well.

CASE 4. DISSEMINATED SPINAL SCLEROSIS.—On March 26th of the present year, I was consulted at office by E. H. W., 54, farmer and miner. He had some symptoms of disseminated spinal sclerosis, though the sensory tract was principally affected, yet there was a slight paresis of the extensors of all the toes and paralysis of the great toes. The upper and lower extremities were about equally affected, though the affection was most marked in the left side. With eyes closed, he could barely distinguish a knife from a piece of money in the right hand, but not one piece of money from another. With the left hand he could not even detect the contact of a knife or a piece of money or feel a lighted match until the skin was severely burned. He had slight ataxia, but his patellar reflexes were normal or slightly exaggerated.

The first symptoms began last winter and consisted of pain, numbness and coldness of the extremities, difficulty of buttoning his clothes, liability of letting things fall from his hands, particularly from the left, frequent stumbling and frequent attacks of insomnia and somnambulism. These symptoms increased until his sufferings were severe, and though he could walk about he had become quite helpless, and could neither dress nor feed himself. His appetite remained good and his general apparance was fairly natural, though he was losing flesh rapidly—his weight having fallen in four months from 210 to 140 pounds.

Prior to this attack his general health had been good, except that some three years ago he was troubled with dyspnœa caused by aortic insufficiency, for which I prescribed iodide of potassium. In the course of a few months the cardiac murmur and the dyspnœa nearly disappeared.

I now prescribed small doses of strychinia before meals, and small doses of codeia for pain and restlessness and administered a stabile galvanic current to hands and feet 10 mil. ten

minutes daily, for a week, and since then three times a week. At each *séance* he was given ascending and descending currents, beginning with a downward current, reversing to upward, reversing to downward, reversing to upward, and reversing to downward. On two occasions, once experimentally and once by accident, the *séance* was finished with an upward current, and on the succeeding nights he was unusually nervous and restless. On every other occasion of treatment the *séance* was concluded as indicated with a descending current. The patient has steadily improved. There is now but little difference in the functions of the two hands, and with either he can detect by feeling different pieces of money, and can definitely locate a touch of any part of either foot, while formerly he could not detect a similar touch at either foot, and at dorsum of left foot could not even locate a pin prick. He rarely suffers now from pain or coldness, and has no abnormal sensations; can dress himself; sleeps better; walks much better and is gaining in strength and flesh, his weight having increased steadily at the rate of about two pounds per week.

To further illustrate my view of the utility of galvanism in chronic forms of spinal disease, where the vessels of the cord in consequence of degeneration are becoming more and more incapable of performing their functions, I conceive that electrical stimulus acting through the vaso-motor nerves will, in alternate use of the upward and downward current, not only fill and empty the vessels and thus materially influence the nutrition of the cord, but incidentally by dilatation and constriction restore the vessels themselves to their natural elasticity and use. (*Woolsey.*)

CHAPTER LX.

ELECTRICAL TREATMENT OF THE EYE.

Paralysis of external muscles. Twitching of the eyelid. Acute ophthalmia from injury, foreign body in the eye, etc. Treatment of conjunctivitis, granular lids and trachoma. Dilatation of the lachrymal duct. To remove irritating eyelashes. Keratitis. Asthenopia from debility, anæmia, the tobacco habit, advancing age or excessive use of the eyes. Congestion and anæmia of the optic nerve or retina. Optic neuritis. Optic atrophy. Retinitis diabetica. Retinitis pigmentosa. Corneal opacities. Ocular hemorrhage. Static electricity in eye affections.

Peripheral Paralysis of the External Muscles.—*Faradic.*—Place a positive sponge-covered hand electrode upon the back of the neck. Employ a smaller negative sponge-covered electrode about the eye. Switch the total compound secondary coil of 2,500 yards into circuit with the rapid vibrator and two or three cells. Increase the current strength through the secondary rheostat until a warm and comfortable tension upon the muscles is produced. At the slightest sensation of pain reduce the current strength.

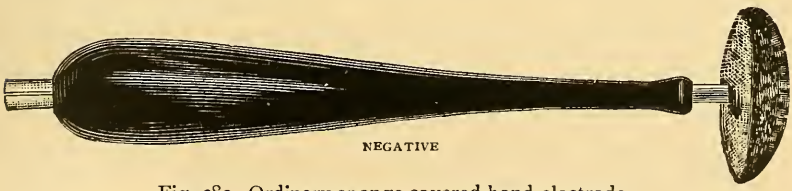


Fig. 389. Ordinary sponge-covered hand electrode.

Slowly manipulate the eye electrode over the lid and upon the attachment of the affected muscles. In about ten minutes reduce current to zero, switch from the rapid to the slow vibrator adjusted to about 100 periods per minute,

and cause nutritional contractions of the paralyzed muscles for two or three minutes at first and for five minutes when improvement has progressed.

Repeat treatment every second day until benefit is established, then three times a week until improvement ceases.

Twitching of the Palpebral or Orbicularis Muscle.—*Galvanic.*—An ordinary sponge-covered hand electrode may be held by the patient and pressed upon the back of the neck or

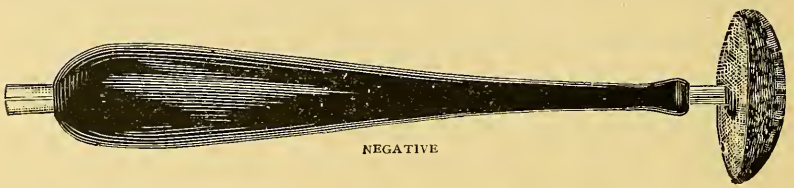


Fig. 390. Ordinary sponge-covered hand electrode.

in front of the base of the ear and connected with the negative pole of galvanic apparatus. Press a small positive sponge-covered electrode upon the irritable muscle and pass a constant galvanic current of from 5 to 8 mil., for about five minutes. Repeat daily. A few applications will usually relieve.

Acute Ophthalmia from Traumatism, Foreign Body in Eye, etc.—*Faradic.*—Press a negative sponge or felt covered electrode upon back of the neck. Wet a thick soft sponge or sufficient absorbent cotton in hot soda-bicarbonate solution, place it upon the closed eyelid and over it press gently an ordinary hand electrode connected with the positive pole of the high-tension coil apparatus.

Switch the combined 2,500 yards of secondary coil, rapid vibrator and two cells into circuit. Gently develop the current through the rheostat until a sedative effect is produced. Continue this for fifteen minutes. I have seen a simple acute case completely relieved of all congestion and pain by one application of this treatment. If the case is

more severe and less recent repeat as often as needed for relief.

Conjunctivitis, Acute or Chronic, Granular Lids, Trachoma.—*Galvanic.*—These various conditions may be treated in any stage by the method of metallic electrolysis. Place a felt or sponge covered electrode of convenient size, moistened with warm bicarbonate of soda solution, upon the back of the neck and connect it with the negative pole of galvanic battery. Anæsthetize the conjunctiva by a few drops of a eucaine or cocaine solution.

With just enough movement to prevent adhesion to the mucous tissues pass a copper eye electrode (made especially

Fig. 391. Set of copper, zinc and silver eye electrodes, insulated on back.

for this purpose) over the entire affected surface with a positive current strength of from two to seven mil. according to the size of the electrode. Withdraw the electrode momentarily as the comfort of the patient demands and repeat the process so that the total application will equal three or four minutes and deposit an effective layer of oxy-chloride of copper within the tissues. Zinc and silver electrodes may also be used and produce less irritation than copper. The experience of physicians in this branch of work will soon enable them to select the best electrode for a given case.

More acute stages require less amperage and duration of treatment than chronic cases. It is wise to protect the eyes from light by colored glasses and to employ a soothing collyrium until the irritation resulting from treatment subsides. Do not repeat oftener than once a week and from four to six treatments will be required.

In a case presenting excessive granulations these may be

destroyed during the progress of this treatment by puncturing each sac with a copper or zinc needle with the negative elec-

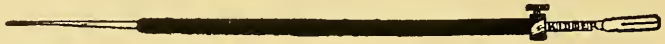


Fig. 392. Needle with adjustable sheath for puncture metallic electrolysis.

trode upon the nape of the neck and passing a constant galvanic current of about three mil. for one minute.

Dilatation of the Lachrymal Duct.—*Galvanic.*—Produce local anæsthesia with cocaine solution, as the treatment is exceedingly painful. The patient may press a positive sponge or felt covered electrode upon the back of the neck. Insert

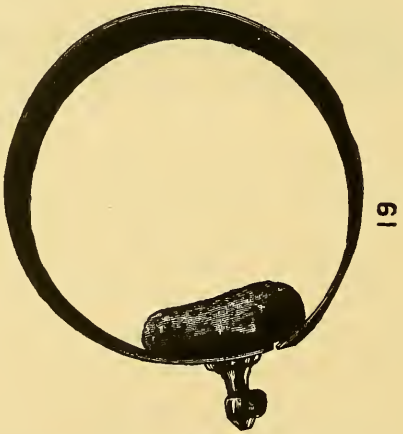


Fig. 393. Self-retaining neck electrode.

gently into the occluded duct a negative probe electrode while a current of 2 mil. is passed for about three minutes. Gradual dilatation ensues, and the size of the probe must be increased with the progress of the case. Repeat not oftener than twice a week. This method is useful and supplementary to other usual procedures. Its operation is slow, requiring from three to six months of careful treatment.

To Remove Irritating Eyelashes.—*Galvanic.*—Seat the

patient in a reclining chair with a head rest and strong light. A reflected light is best. Place a felt or sponge covered electrode upon the back of the neck with the positive cord attached and its tip held by an assistant. If no assistant is present have the patient hold tip.

Fix a fine brooch electrode in its handle and connect with the negative pole of the galvanic battery. Adjust the meter to read for small currents and adjust rheostat and cells in

Fig. 394. Set for removal of hair, contains two fine iridio-platinum needles, four steel brooches, insulated handle, epilation forceps and magnifying glass.

circuit so that when the needle is inserted in the hair follicle the current strength will be about 2 mil. Apply a 4 per cent. cocaine solution to relieve pain. Insert the fine brooch to the depth of the hair follicle and in the direction of the hair root. Hold steadily in place and complete the circuit by touching the tip of the positive cord upon the positive terminal post of the battery. This must be done, when needed, by the patient or assistant who holds the tip.

As soon as froth is seen to bubble up about the needle—it takes but a moment—have the tip removed from the positive contact to break the circuit. Withdraw the needle and the hair should pull out without resistance if it has been properly loosened by the electrolytic action.

If there are a number of hairs to be destroyed repeat the process at a single sitting only upon a portion in order to consult the comfort of the patient as well as the operator's con-

venience. Some pain occurs during the process, and if the root of the hair is not entirely destroyed it may grow again.

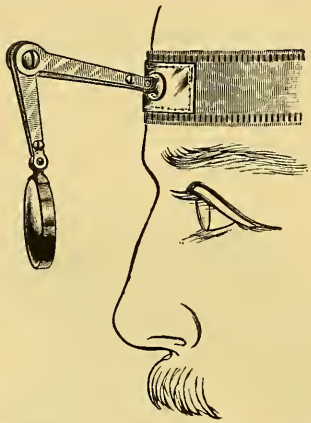


Fig. 395. Neiswanger's magnifying glass, mounted on head band. (*McIntosh.*)

In the operation for the removal of superfluous hair by electrolysis, a good magnifying glass is an essential requisite, and as it is a matter of great inconvenience to use the ordinary glass (both hands being already employed with needle and forceps) the above has been devised. It is light and convenient, and can be used on the head of the operator or patient. Being provided with two " ball and socket" joints it is easily and quickly adjusted, and the focal distance being five inches, allows of ample working room between the glass and seat of operation.

Keratitis.—*Galvanic.*—Apply an ordinary sponge or felt covered, flat electrode to the back of the neck and connect it

Fig. 396. Eye electrode with glass cup.

with the negative galvanic binding post. Fit to the affected eye an eye cup electrode filled with a one per cent. saline solution, warm, and attached to the positive pole. Pass a

constant galvanic current of about three mil. with lid closed for five minutes daily until relieved.

"This is a valuable adjunct to other treatment, helping to relieve spasm and photophobia and hasten the cure."

Asthenopia from Debility, Anæmia, the Tobacco Habit, Advancing Age or Excessive Use of the Eyes.—Besides a general upbuilding of the system by such measures as will improve nutrition, the direct local treatment of the eye and its nerve supply may be instituted with either sedative-tonic faradization or static electricity, both of which produce benefit by similar principles of action.

Faradic.—Place a positive sponge-covered electrode upon the back of the neck. Press upon one eye a cup electrode filled

Fig. 397. Eye electrode with glass cup.

with a warm 1 per cent. salt solution to make a liquid contact with the entire surface. Connect this electrode with the negative pole of the high-tension induction coil apparatus.

Switch the rapid vibrator, 1,500 yards No. 36 coil and two or three cells into circuit. Keep the lid closed during treatment. Increase the current gently from zero through the secondary rheostat until a fine warming and tonic thrill is felt throughout the eye. Avoid any excess of current strength which would produce an ache.

In about five minutes reduce the current to zero and apply the same method to the other eye. Repeat daily for a few times, then three or four times a week. Satisfactory improvement should appear in from ten to fifteen sittings. If the case is complicated and chronic a longer time must be allowed.

Static.—The employment of static electricity for functional asthenopia gives us the advantage of treating the entire

patient nutritionally at the same time we are benefiting the neurasthenic eyes.

The *general* methods to employ will depend upon the state of each patient, and explicit directions covering all cases will be found in the various chapters of this work.

Direct Treatment.—With the patient seated upon the static platform and electrified negatively, ground the brass point electrode, and beginning with a mild spray over the upper spine and region of the cilio-spinal centre gradually increase the intensity of the application until active counter-irritation is produced.

Next, with either the wooden ball electrode, or the brass point (if the operator is sufficiently skilled to make the application without startling the patient with undesired sparks), throw repeated showers of stimulating spray upon the closed eyes and entire frontal region. Among the auxiliary methods which will most frequently assist in the treatment of these cases will be a tonic breeze or mild sparks to the spine, general positive electrification, the author's method of potential alternation, and if headache occurs a positive breeze upon the region of the head affected.

Although the work of the oculist in special practice is almost exclusively limited to the local treatment of the eye, yet patients often present conditions which local measures do not reach and which manifest strong indications for static electricity.

Congestion and Anæmia of the Optic Nerve or Retina, with Blurred Vision, Fatigue and other Symptoms.—*Faradic.*—Place an ordinary sponge or felt covered, flat electrode upon the back of the neck over the cilio-spinal centre. Fill an eye cup electrode with a warm 1 per cent. salt solution and apply to the

Fig. 398 Eye electrode with glass cup.

affected eye. If congestion is present the eye electrode should be connected with the positive pole. If anæmia is present the eye electrode should be negative. In the absence of an ophthalmoscopic examination to detect the exact state it is a simple matter to make a tentative trial of both polarities and continue the one which gives the greatest relief. Marked sensitiveness is an indication for the positive pole and it should always be tried first, especially if the external eye is congested.

Switch the 1,500 yard No. 36 induction coil into circuit with the rapid vibrator and two cells. Gently increase the current through the secondary rheostat from zero until the desired effect is produced. The effect sought may be either positive sedation or mild negative stimulation and the current strength must be regulated accordingly.

Let the application last eight or ten minutes and repeat daily at first. As improvement progresses the interval between sittings may be lengthened. In all curable cases relief will begin early and be rapid.

Optic Neuritis, causing Blindness.—*Galvanic.*—Upon the closed lids of both eyes apply a double spectacle electrode, or

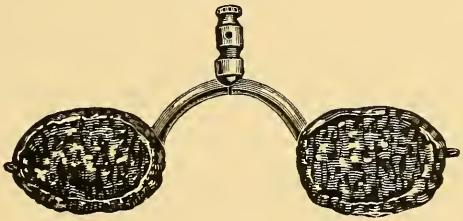


Fig. 399.

two separate electrodes with a bifurcated cord. The electrodes may be covered with sponge or absorbent cotton and moistened in a warm bicarbonate of soda solution. Connect with negative galvanic terminal post.

Place a positive sponge or felt covered electrode upon the back of the neck over the cilio-spinal centre. Gradually increase the constant current from zero until a current strength

is reached, which begins to produce discomfort at the eye electrode, and at once reduce slightly below this point. Two to four mil. for each eye is an average dose.

Length of sitting five minutes. If irritability is caused by the negative polar action at any time, employ the positive pole temporarily until it subsides.

In an early stage of treatment—as soon as tolerance is established—close each *séance* with a few sharp reversals of the current to stimulate the nerve. Gradually make these mild stimulations as strong as the eye tolerates with comfort. When flashes of light are thus obtained it is a favorable indication. Repeat treatment three times a week until improvement ceases.

In a curable case improvement will result in a few weeks, but the maximum of benefit will require time, especially as treatment of chronic cases is often interrupted and may not average more than one or two sittings per week.

Tabetic Optic Atrophy.—*Galvanic.*—Place a soft sponge-covered hand electrode over the eye with the lid closed and a similar electrode of larger size upon the back of the neck over the cilio-spinal centre. Connect the spinal electrode with the positive pole. Pass a constant galvanic current of from two to four mil. for five minutes, regulating both the intensity and time to the point of comfortable tolerance. During the sitting make about three reversals of the current and close with the negative upon the eye. Make the reversals by reducing the current to zero and gradually increasing it again after shifting the pole changer.

As blindness is so great a misfortune this method may be tried in cases in which the disease is not running a very rapid course and before it has reached an advanced stage. The benefit may be sufficient in any given case to encourage persistence in treatment, although beneficial results will be less marked after early stages of the disease are passed. When no improvement appears to be obtained the method may be discontinued.

Optic Atrophy.—*Galvanic.*—Place a felt or sponge covered, flat electrode upon the back of the neck over the cilio-spinal centre, with an eye cup or sponge-covered electrode upon the closed eye. Begin with the eye cup negative and increase the constant galvanic current from zero up to between three and five mil., keeping within tolerance. Continue sitting five minutes, making three or four sudden reversals of polarity and concluding with the eye electrode negative. In reversing the polarity reduce the current strength below the point of discomfort.

Repeat daily for one or two weeks and continue sitting three times a week until improvement ceases. Then intermit for a month and observe results. Renew treatment for short periods until benefit is no longer obtained.

Retinitis Diabetica.—*Galvanic.*—Felt or sponge covered,

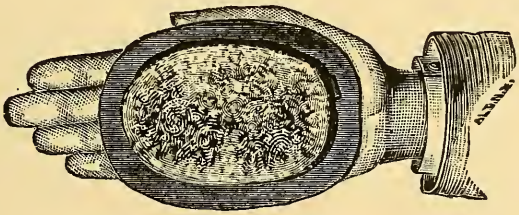


Fig. 400. Sponge-covered flat electrode.

flat electrode to nape of neck over cilio-spinal centre, connected with negative galvanic pole. Eye cup electrodes filled with warm saline solution to eyes with the lids closed. (Sponge-covered electrodes may be used if desired.) Increase the constant galvanic current from zero up to about four mil., or just

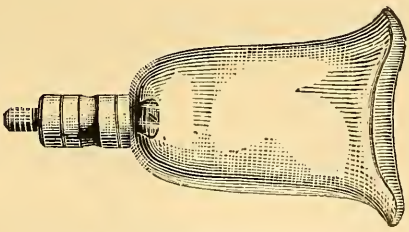


Fig. 401. Eye cup electrode.

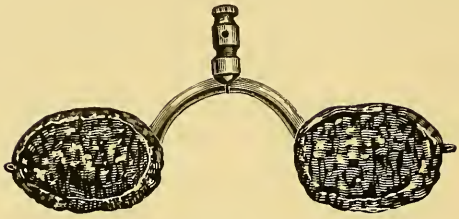


Fig. 402.

sufficient to produce sensation without discomfort. Hold the current steadily for one minute, then reduce and reverse polarity, again increase the current and make three such reversals at each sitting, closing the treatment with the eye electrodes positive.

Treatment may be daily at first and later two or three times a week. Continue several months or till improvement ceases. This method is supplementary to dietetic and medical treatment of the diabetes. It is available for those who do not possess a static machine, but with the latter apparatus local treatment of the eye in this manner is subordinate and better results are obtained.

Static.—The general treatment of a diabetic patient is given under the proper heading. The treatment for the eyes, if any is needed, is the same as described for asthenopia in this chapter. For a full appreciation of the value of static electricity in this affection the reader is referred to the chapter upon the electro-physiology of currents of high potential and high frequency.

Retinitis Pigmentosa.—*Galvanic.*—To the eye apply the usual eye cup electrode or any electrode covered with soft

Fig. 403. Eye electrode with glass cup.

sponge or absorbent cotton to furnish a suitable contact. Connect this electrode with the positive galvanic pole. The negative electrode may be placed as usual over the cilio-spinal centre or upon the frontal region over the eye cup. Pass a constant galvanic current of about three mil. for five minutes twice a week. Persistence with this or any other method is essential to results and the benefits are partial only.

Corneal Opacities.—*Direct Galvanic Application.*—Place a positive felt or sponge covered, flat electrode upon the back of the neck. Secure local cocaine anæsthesia of the eye. Apply a negative corneal electrode directly upon the site of the opacity with a constant galvanic current of from one mil. to one and one-half mil. Duration of sitting three to five minutes. Repeat twice a week. Improvement slow. A method much more satisfactory to the patient and more easily employed by the general practitioner is given below.

External Galvanic Applications.—Place a soft sponge-covered or felt electrode upon the back of the neck over the cilio-spinal centre. Press upon the closed eyelids an ordinary hand electrode covered with a fine soft sponge and well moistened with the bicarbonate of soda solution. If the eye is congested before treatment or becomes congested or painful during the application connect the eye electrode with the positive pole until irritation is allayed; otherwise it should be negative during the entire course of treatment.

Pass a mild constant galvanic current, increased through rheostat from zero to three, four or five mil. (according to tolerance) for from three to five minutes. If the eye is irritable at first limit the current strength to two mil., and throughout the course of treatment avoid producing any sense of discomfort by too strong a current.

Repeat every second day until improvement is advanced. Later sittings may be twice a week. Of this method Hall reports:

The case in which I first used it was one of recent macula

of both corneæ, visible at a distance of several feet. It has now, six months later, wholly disappeared from one eye and is barely discernible in the other. I expect the continued use of the current to remove all trace of blemish and defect of vision.

In another case taken up a few days later a kidney-shaped macula two and a half lines in length is now represented by a thin, speck-like spot which the patient and her friends no longer see. This too is steadily melting away.

Seven other cases under treatment, varying in size from a millet seed to the whole circumference of the corneæ, from a nebula to a dense white leucoma and in duration from forty days to forty-eight years, are all steadily improving. Two of the most extensive maculæ are now merely fragmentary remains of the original, while the corneæ elsewhere are quite clear. The rate of disappearance seems to depend chiefly upon the size of the opacity which, like a heap of snow, melts away from the periphery towards the centre, the oldest but little more slowly than the most recent.

Of cicatricial corneal leucomas Lambert also reports :

Child, aged 3½ years, purulent ophthalmia when two months old. On examination found dense cicatricial corneal leucomas, anterior synechiæ, and very dense cicatrices in the centres of the corneæ. No iris visible by either direct or oblique illumination. Corneæ were as opaque as the sclerotics and there was marked mystagmus. Prognosis very unfavorable.

Treatment.—One electrode over closed lids sometimes positive, sometimes negative, the other electrode held in the hand. A mild constant galvanic current was applied from three to five minutes twice each day for six weeks.

The dense leucomas cleared up very rapidly, commencing at the peripheries. The good effect was noticeable in three days, and at the end of six weeks the beautiful blue iris of each eye was exposed to the extent of about one-half in the left and one-quarter in the right eye. Two months later did an iridectomy. The unruly nature of the child and the mystagmus made the case troublesome. Six months later the child could recognize people and pictures and go about alone. Does not galvanism properly applied in these otherwise hopeless cases offer a boon to the many thousands of blind children ?

In my own experience with a case of this kind I have seen slight improvement appear manifest to the patient as early as

the third treatment. The softening and absorbing action of the negative galvanic polar action is indicated in these cases, but instead of placing the positive electrode in the hand it should be applied to the back of the neck, and the saturation of both electrodes and tissues with warm bicarbonate of soda solution will secure the desired amperage with the least possible voltage, and consequently the least liability of irritation.

In making these applications in the manner which I have described the electrolytic action has been secured with perfect comfort to the tissues of the eye and with benefit to the nutrition of the parts in addition to the absorption of the opacity. I do not know how generally the method has been tested by oculists, but from theoretical considerations and the limited experience in this field which the general electrotherapeutist acquires it would seem to be very promising of good results when carried out with perseverance.

Ocular Hemorrhage.—*Galvanic.*—Apply a positive sponge-covered flat electrode of medium size to the back of the neck. Connect the eye cup with the negative pole and apply it to the affected eye, filled with a warm bicarbonate of soda solution.

Fig. 404. Eye electrode with glass cup.

Increase the constant galvanic current through rheostat from zero to between three and five mil., keeping the dose below the point of causing pain.

Length of sitting may be limited to three minutes at first and afterwards increased to five and ten minutes as tolerance and improvement progress. Repeat three times a week.

Frankhauser says that in the treatment of intra-ocular hemorrhages and vitreous opacities negative galvanic electrolysis promises better results than any other form of treatment and cites his experience as follows :

A young machinist had an explosion in his pipe while smoking, probably from carrying a cap for a dynamite cartridge in his pocket with his tobacco. His left eye was cut through the upper lid, about midway between the inner and outer canthus, making an incision posterior to the corneo-sclerotic junction of three-eighths of an inch in length which was followed by extensive hemorrhage from the wound into the posterior chamber.

When a strong light was reflected into his eye he had no light perception. The anterior chamber was free from hemorrhage.

He was treated more than four months with potassium iodide, jaborandi, mercury, blisters and tonics, without any result. He then commenced galvanic absorption. After four weeks of treatment he could tell light from darkness, and soon after a part of the retinal reflex could be detected with the ophthalmoscope. In two months he could see the light and in a year his vision was 10–xx.

Another case had retinal hemorrhage, probably from diabetes. After some exertion one day he found that he could not see light with one eye. The vitreous was clouded, giving a faint reflex with the ophthalmoscope. Under general treatment the cloudiness was partially remedied in three months. He then had an attack in the other eye almost as bad as the first. The second eye cleared fairly well, but the hemorrhages recurred in both eyes during the year. As one eye would improve the other would get worse. After a year's treatment directed to the diabetes and the general health galvanism was tried for both eyes once a week. In a short time both eyes cleared to 15–xx.

In a few months another hemorrhage occurred in the first eye shutting out all light. The galvanic current was continued once a week, the patient living at a distance which made it inconvenient to attend oftener.

In two months the vision had markedly improved and has held its own ever since. No hemorrhage has occurred for more than a year. Earlier in the history the slightest exertion would bring on a hemorrhage; now he can do light work on a farm and his vision appears to be improving.

Static Electricity in Eye Affections.—The chief currents employed for local treatment of the eye are necessarily the galvanic and fine coil faradic. The static machine affords an adjunct remedy of great *general* value. In the case of diabetic hemorrhage cited above the use of static electricity would

perhaps have made quite a different story of the result. Further information may be obtained by reading the section of this book referring to Diabetes.

Apart, however, from the direct treatment of the eye the static machine renders other important services in the treatment of patients whose eye states are associated with neurasthenia, general debility, headaches, or any of the large class of functional derangements and general diseases in which static electricity is a time-tried and efficient remedy. A study of its physiological actions and practical facility of clinical employment will repay those who are especially interested in the treatment of patients who present affections of the eye associated with ill-health.

CHAPTER LXI.

ELECTRICAL TREATMENT OF THE EAR.

Chronic inflammation of the middle ear and sequelæ. Meniere's disease. Tinnitus aurium. Treatment by galvanic current. Treatment by vibratory massage. Acute nervous deafness. Treatment of catarrhal deafness by vibratory massage. Static electricity in diseases of the ear.

Proliferous or Chronic Non-suppurative Inflammation of the Middle Ear and Sequelæ of Long Passed Acute or Suppurative Inflammation.—*Galvanic.*—Incline patient's head so that the ear will be uppermost. Fill the meatus with suffi-

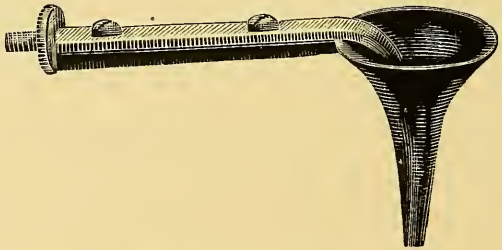


Fig. 405. Ear electrode.

cient warm solution of soda bicarbonate, and insert an insulated rubber ear speculum connected with the negative pole. If the Eustachian tube is pervious, the positive pole is connected with an ordinary sponge electrode pressed under the angle of the opposite jaw.

Increase the constant galvanic current from zero until it produces a sensation of comfortable warmth and continue the sitting for about ten minutes. Repeat every second day.

The increased supply of blood to the periphery increases absorption. On inspection after treatment the parts are seen to be intensely red and congested. The tubes soon become

easily pervious, even attracting the notice of the patient. In time the drum-head and malleus are seen to become more movable, and improvement in hearing follows. In conjunction with this the ordinary treatment of the throat and naso-pharynx should be pursued. (*Jones.*)

Meniere's Disease.—Last October Mrs. H., 26, married, and mother of two healthy children, and herself in apparent perfect health, consulted me about "ringing in ears and noises in head," particularly troublesome in the right ear, which had troubled her for two years, and which at times caused such confusion that hearing was difficult.

She was examined by an aurist who expressed to me the opinion that the case was one of Meniere's disease. She had accidentally discovered that quinine would relieve her, but also, that when used daily for some time, it aggravated the trouble; so had come to use it only on occasions of social events. I gave her with ordinary sponge electrodes, from ear to ear, a current of ½ ma., delivered by rheostat, and reversed frequently during *séance* of five minutes, but reversed by changing the electrodes, as the shock of reversal by pole-changer caused pain. During the *séance* she expressed herself as somewhat relieved, and on the following day stated that the noises did not trouble her for two hours after *séance.*

I administered the same treatment daily, except Sundays, for a month. The result of each treatment was nearly the same except that from day to day the subsidence of noises, etc., during *séance* was more and more complete and the after relief more and more prolonged. On two different occasions, however, I finished the *séance* with the positive electrode at the right ear, and upon her return after such treatment she complained that she had not received the usual benefit. On all other occasions I finished the *séance* with the negative pole at the right ear.

At this time—after a month's treatment—she seemed quite well, except that after any unusual excitement there would be a temporary return of noises, etc. I now gave only three or four treatments a week until Christmas time, and for some weeks she had not had the slightest return of her trouble. I did not see her again until the middle of January of the present year, when she returned in almost the same condition as when I first saw her. I resumed the same treatment, with the same measure of improvement, and for a month she has had but two *séances* a week and has not had any return of noises, etc. (*Woolsey.*)

Tinnitus Aurium.—Moisten an ordinary hand electrode

covered with felt, absorbent cotton or sponge in warm bicarbonate of soda solution, connect it with the negative pole of

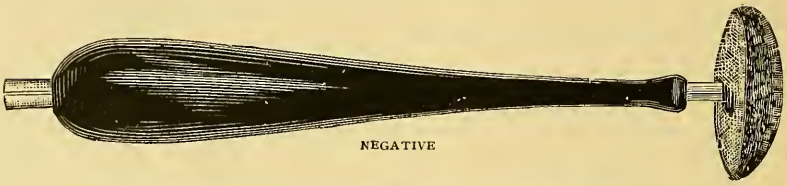


Fig. 406. Ordinary sponge-covered hand electrode.

the battery and have the patient press it upon the opposite side of the neck in the sub-maxillary fossa. Wrap a small pledget of absorbent cotton around any metallic tip electrode of

Fig. 407.

suitable size, wet it in the soda-bicarbonate solution, connect it with the positive pole and press gently into the external auditory meatus. Slowly increase the constant galvanic current through a rheostat from zero up to three, five or even ten mil. if required, ascertaining from the patient the dose which affords the best relief. Hold the current at the ascertained dose for five minutes. Then very slowly reduce to zero, spending at least three minutes in the process. Attention to this detail is important.

If the positive pole does not lessen the noise, try the negative in the meatus, and if neither give any relief the galvanic current need not be continued.

As relief is only partial and temporary at first, even in favorable cases, the sittings may be daily for a week if required. Three times a week may, however, be sufficiently frequent treatment in some cases, and when improvement is advanced, twice a week is the rule until benefit ceases.

If an active cause is not still at work the results of this method are generally satisfactory and often surprising to the patient. It should be tried first.

If both ears are affected use a bifurcated cord, or binaural electrode, and apply the positive current to both ears at once, with the negative upon the back of the neck.

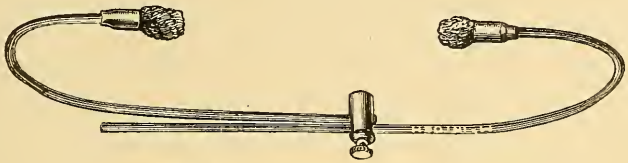


Fig. 408. Double ear electrode.

Vibratory Massage.—Some cases of tinnitus aurium yield to rapid mechanical massage. Several special instruments are made for this purpose. With the aid of a telephone receiver the author's high-tension induction apparatus may be used.

Fig. 409. High-tension apparatus.

If only one ear is affected, have the patient hold the receiver to the ear in the usual manner and connect both its terminals to the two poles of the battery. If both ears are affected press the soft rubber bell of a stethoscope upon the telephone receiver and insert the ear pieces in the patient's ears. No regulation of current strength by means of a rheostat is required, for no electrical current reaches the patient

through the hard rubber insulation of the telephone receiver. Sound waves are created for the purpose of this application, which is therefore not an electrical one.

Adjust the rapid vibrator to smooth action and regulate the force of the sound wave entering the ears by increasing the E. M. F. of the current and by employing different coils until the dose is ascertained. The long fine coil will produce waves of maximum fineness and tension, while the volume of sound increases in proportion as shorter and coarser coils conduct currents of increased amperage.

The sound which is full yet comfortable, and which seems to penetrate best, may be maintained while it produces relief —from five to fifteen minutes. If the first few sittings give no relief whatever it is probable that this method is not indicated.

Acute Deafness Due to Concussion, Hysterical or Other Functional Disturbances of the Auditory Nerves.—These cases may be treated by the same methods described for tinnitus aurium.

Catarrhal Deafness.—*Vibratory Massage.*—For reports of clinical cases and fuller discussion of mechanical methods of treating this affection the reader is referred to journal articles during the past four years. Also the following :

Sound waves which impinge upon the tympanic membrane are transmitted across the tympanum by the chain of auditory ossicles and thence into the labyrinth. Among the pathological changes found in chronic catarrhal inflammation of the middle ear are: (1) Secondary thickening of the membrana tympani due to a new connective tissue formation, or to metamorphosed infiltrations due to inflammation; (2) abnormal adhesions between the sound-conducting parts of the middle ear, viz. : adhesions of the membrane to the ossicles of the tympanic walls, between the ossicles themselves or of the ossicles and the walls of the tympanum ; (3) hypertrophy of the membranous portion of the eustachian tube with its resulting closure.

The sense of hearing depends in this disease upon the susceptibility of the sound-conducting apparatus to readily receive and transmit sound wave to the perceptive elements.

We have seen from the pathological changes named as occurring in catarrhal deafness that this susceptibility must be greatly interfered with from the hypertrophic and adhesive changes. The theory of the treatment of this condition is that by causing rapid and forcible sound waves we create powerful vibrations or motions in these sluggish and adherent structures, and by this massage the adhesions become stretched and broken and the hypertrophy reduced through the increased circulation and nutrition causing absorption of the new products thrown out by the catarrhal inflammation.

The sphere of massage is limited to catarrhal deafness of the hypertrophic form, and of these I believe that at least three-fourths of the cases should be benefited. In atrophic catarrh or involvement of the nerve itself I have failed to get any benefit whatever. In my opinion, while it is not a cure-all, I believe that massage is the best method of treating chronic catarrhal deafness at present known, because it seems to me to be theoretically and practically in the right direction, and to make still more perfect simply remains a matter of more perfect instrumentation.

I believe it to be especially valuable in hypertrophic catarrhal deafness when associated with or accompanied by tinnitus; further, that the range of the present apparatus allows it to cover and relieve more cases of tinnitus than any other one instrument at present devised for applying massage to the ear.

Among effects of massage which I have not heretofore seen recorded are an increased secretion of cerumen showing a more normal action of the secretory glands of the external canal, and also greater ease in opening the eustachian tubes by Politzer's method owing to a reduction of its hypertrophic lining membrane due to the massage. In one case of Dr. Sheppard's where he had been unable after several weeks' treatment to inflate the middle ear previous to using massage the tubes were easily opened each time after the first few applications. This effect has been noticed in a great many cases.

There have been in my hands no bad effects. I request a month's thorough trial of the treatment in all cases before it shall be condemned as of no value in any particular case. Very few cases are completed in one month's treatment, and all that is expected in that time is to demonstrate to the patient more or less gain. If at the end of a month there is no improvement whatever we can fairly say that it is not adapted to the case, but on the contrary if there is any gain I believe greater benefit can be had from following it up for a longer period.

As catarrhal deafness is a disease of slow and insidious course and has usually existed for years before treatment is undertaken, it cannot be expected to yield in a few weeks. My plan is to give three treatments a week for the first two or three weeks; if then there is no gain, I use it daily for a week or ten days for more thorough trial. As a rule more or less marked benefit is found within the first two or three weeks. The treatments should thereafter be continued three times a week so long as any gain is determinable, and when there ceases to be any further improvement the intervals should be gradually lengthened so as to hold what has been gained and not drop off treatment too abruptly.

In commencing treatment each sitting is from ten to fifteen minutes' duration, gradually lengthening each sitting to about one half-hour. I am aware that this is a longer time than is usually recommended by others, but I have gradually grown into it with more favorable results.

In closing I would reiterate that in my opinion the theory of treating catarrhal deafness by massage is a most decided advancement upon the present methods in the treatment of this most obstinate disease. (*Norton.*)

Physicians who do not possess the apparatus of the ear specialist but who are equipped with the author's induction coil apparatus may institute similar treatment by an additional outlay of less than two dollars for an ordinary telephone receiver. The manner of using it is fully described under Tinnitus Aurium, and the tinnitus associated with catarrhal deafness appears to be a form which is sometimes relieved by massage. Those who have had the opportunity of observing several hundred cases state that the exact indications for this method are yet undetermined, and that in about one-half the cases in which it *appears to be indicated* the results prove to be disappointing. In my own limited experience with this disease I have considered that the ability to hear better amid surrounding noises rather than in a quiet room indicates this method, and that when the prognosis is favorable the patient will remark at the close of the treatment that the ear feels opened up and as if sound entered better.

The great variety of sound regulation which rapid switch changes in the induction coil apparatus will produce may be

wholly unsuspected by the physician who has never tried it, and there is probably no difference between the possible effects which the inexpensive telephone receiver will thus produce and the reported effects of the more costly apparatus.

Static Electricity.—Every one who treats diseases of the ear can derive some help from galvanic and faradic currents which will be found invaluable in quality although less extensive in therapeutic range than could be desired. Apart however from the direct treatment of the ear the static machine renders a peculiar service in the treatment of patients which cannot be equalled by any of the other resources of medicine. Mental states, painful and neurasthenic conditions and functional derangements are frequently associated with chronic affections of the ear and do not participate in the benefit which local treatment affords. A positive static head breeze will often do much to complete the satisfaction of the patient, and the entire resources of this agent will often be found useful. For indications and methods the reader is referred to the various chapters of this work.

CHAPTER LXII.

ELECTRICAL TREATMENT OF THE NOSE.

The electro-cautery in nasal diseases. Fundamental principles of cautery application. Atrophic rhinitis. Chronic rhinitis, ozœna, etc. Metallic electrolysis. Interstitial electrolysis. Clinical remarks. Hypertrophy of the nasal septum. Anosmia.

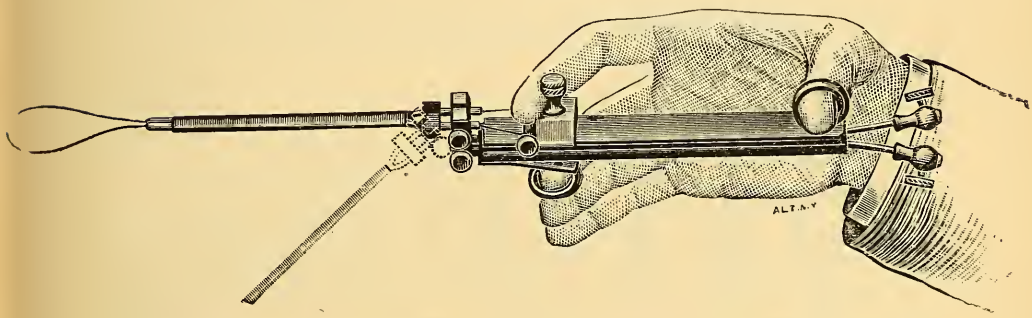
The Electro-cautery in Nasal Disesaes.—According to Dunn there are three conditions of symptoms for which operations are performed within the nose: hyperæsthesia, nasal stenoses and excessive secretion. The class of cases of nasal stenoses in which the electro-cautery is of greatest service are those in which hypertrophy of the inferior turbinated is the principal factor. The surgeon must exercise his best judgment before operating. Two conditions govern the success of the electro-cautery in hypertrophy: 1. The density of the hypertrophy; 2. the formation of the turbinated body in relation to the septum.

Fig. 410. Eye electrode with glass cup.

When the turbinated tissue is large, extremely dense, and particularly if it has been treated by astringent applications, the electro-cautery is insufficient when the growth involves a whole or a large portion of the turbinated tissue. The scissors will do much better service and the result prove more satisfactory.

A large number of cases in which the turbinated bones occupy much of the space of the inferior meatus and on which has grown a considerable amount of hypertrophy again find the electro-cautery unsuitable.

When the hypertrophy is pedunculated the electro-cautery snare can be successfully used, especially if the growth be in the deeper portion of the nose. The electro-cautery is of invaluable service in destroying the last vestige of polypi which must be searched out in the small cavities in the superior portion of the nose.



Fig, 411. Ecrasure handle adjustable at any angle with circuit closer. For loop or burners.

Excessive nasal secretion accompanies both hypertrophic and atrophic rhinitis, but we find the electro-cautery of the greatest aid in the hypertrophic condition. The most frequent and persistent type of post-nasal secretion is produced by the small whitish hypertrophies that are to be found on either side of the posterior end of the septum. The discharge is thick and tenacious and produces much hawking and hemming to free the nasal pharynx. These hypertrophies sometimes involve an excessive portion of the posterior end of the septum and are disagreeable in the extreme. The most successful treatment is the careful destruction of this hypertrophic tissue with the electro-cautery. It is necessary to destroy the whole of the tissue, which should be done one side at a time.

With a tongue depressor the patient depresses his tongue, while with the left hand I operate the rhinoscopic mirror (in the throat) and with the right hand the electro-cautery with a flat blade (through the nose).

The electrode should be laid on the surface of the hypertrophy and heated. It is impossible to destroy the whole of the hypertrophy, if it be large, at a single application, as it is best not to attempt moving the electro-cautery point, and when it is removed from the nose it should be done with a quick motion in order not to burn the nasal opening. The whole of one side should be done at a single sitting and the second operation performed in a week or ten days.

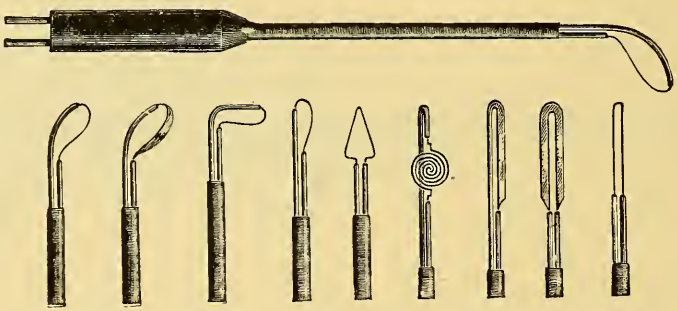


Fig. 412. Throat and nasal cautery electrodes, with flexible insulated rods, that can be formed to any curve or angle desired. (Kidder Mfg. Co.)

Hypertrophy of the posterior ends of the turbinated are frequent sources of secretion which is of similar type to that just described, but as a rule less tenacious. Such growths are more successfully removed by the electro-cautery snare, but in some cases in which the hypertrophy is not great may be removed in the same way as the hypertrophy on the septum.

Granulations in the nasal pharynx may require the electro-cautery on account of the excessive secretion they produce, which causes similar symptoms to the other forms of post-nasal discharge.

Many operators are in the habit of treating the nose repeatedly with the electro-cautery or other escharotics instead of a thorough destruction of the hypertrophic tissues at a single application. This I believe to be bad practice as a rule in hypertrophic cases. It is not desirable to keep the nose continually irritated by repeated applications.

In hyperæsthetic conditions where much surface must be treated it is necessary to make several applications, none of

which should involve more than the mucous membrane. The relative value of the electro-cautery with other escharotics has always been much in debate, but it is my experience that when it is necessary for any cause to remove tissue the chemical escharotics are of doubtful value and much more painful. It is possible to do as gentle and mild an operation with the electro-cautery as with the chemical escharotics, while I believe it to be more under the control of the operator and less reaction follows its application. (*Dunn.*)

While the uses of the electro-cautery in practical work are only to be developed by individual practice it will assist readers to a correct understanding of the fundamental principles of cautery applications to lay before them the admirable presentation of the subject recently made by Dr. Horace Clark of Buffalo.

The galvano-cautery is an instrument of precision to a greater extent than is commonly supposed. Along with a spray-producing apparatus it is frequently found as a part of a general office outfit. The text books are largely responsible for this misinformation. They advise the cautery as a remedial or curative measure, without specifying how to use it. Granted that each operator must learn by experience the refinements of cautery technique, there are certain gross principles applicable to the proper use of the instrument which should be more generally understood.

(1) First, as to the degree of heat to be used. Every storage battery is provided with a rheostat—an apparatus to regulate the degree of heat to be carried to an electrode; but how many times has the rheostat been handled to-day simply as a means of making the cautery work, the operator not having the remotest idea whether a dull red, bright red or white heat was required for the result he had in mind?

(2) In cautery work it is always best to do but one side at a time. The reasons are obvious. But both nostrils should be opened, and without undue interval. The idea to be borne in mind is the principle of division of labor. An excessive amount of air taken in through one nostril, no matter how large the opening may be, is a source of irritation and excites over-nutritive activity. Both nostrils should be open, in order to present as large a surface as possible to warm, moisten and cleanse the inspired air. For reasons relating to the ear, they should both be open. When there is a mixed condition it often happens that a soft hypertrophy, for example, of the posterior

portion of one of the turbinated bodies, will take care of itself after the reduction of the hard hypertrophy.

(3) The preparation of the part is a matter of importance. After being properly cleansed on general surgical principles, it should be dried before the local anæsthetic is used (cocaine or eucaine) and afterward dried again. It is usually unnecessary to use a cocaine spray for anterior cautery surgery, nor is a great wad of saturated cotton required for topical application. A thin piece, wrung nearly dry, nicely adjusted to the part with a probe, is sufficient. The length of time for the cotton to remain is a variable quantity. Ten to fifteen minutes for a ten per cent. solution of cocaine, and two or three minutes less for a eucaine solution of the same strength, is usually sufficient. Sometimes insensibility to pain is all that is required or desired. That, too, is a variable quantity according to the character of the tissue. Too much shrinking may be an actual hindrance to operation, and leaves the operator at a loss how far to go; for example, in cases of polypoid thickening, when the cautery is chosen as against the snare or other instrument. But the point I want to make is that in the majority of cases the part should be made bloodless, or as nearly so as possible. Ischæmia and insensibility to pain are not necessarily required to be co-existent. I believe this matter is of great importance. If it were not that it does not produce ischæmia, the new preparation for local anæsthesia could happily replace cocaine entirely. I refer to eucaine. It is equally good for anæsthesia and solutions are more stable. It is entirely soluble in "crystal-water" solutions; faucet water should be boiled. In many operations, when extreme shrinkage is not desirable and the tissue is practically bloodless, eucaine is even more desirable than cocaine. The desideratum is to combine with it some substance which will produce an ischæmia in addition to its own anæsthetic property.

(4) As to repetition of the use of the cautery, it is always well to hedge a little in answering that question. Not that it is an uncertain instrument, but the tissue upon which it is used is uncertain. Given a lower turbinated body in practically a uniform condition throughout, so far as can be ascertained, the cautery is applied equally. The result may be a face as firm and flat as if a piece of putty had been cut through with a sharp knife. Or it may present elevations here and there. (One of the latter may be just opposite to a protuberance or hypertrophied portion from the septum, harmless perhaps in this particular case if not in contact. Therefore the destructive agent has been sufficient for the most part, and would have been carried too far in such a case had it been pushed in

the first instance, so that no elevation opposite the protuberance had resulted.) These elevations, or others, are to be met separately at another sitting.

(5) The cautery should be sparingly and cautiously used upon the septum. Incised wounds of the septum heal with surprising rapidity ; but I have seen many cases of obstinate erosion caused by the ill-advised use of the cautery on this part. If there is undue bleeding from a cutting operation upon the septum, it is better to stop it in some other way than with the cautery. An operator will take great pains to grease or otherwise protect the face of an acid applicator which might touch the septum, and yet he will force the cautery electrode into a space so narrow as to burn the septum as well, thereby producing an agglutination between the parts, only aggravating the condition he sought to reduce.

(6) It is well to avoid using the cautery in the presence of a tuberculous or syphilitic diathesis. I recently saw a case in which a simple erosion upon the cartilaginous septum was transformed by excessive irritation with the cautery into a syphilitic ulcer; that is to say, the disease, having a predilection for the septum, manifested itself at a weakened portion. The erosion was caused by picking with the finger, crusts having adhered in the hollow of a slight undulation. The cautery had been used in the hope of forming scar tissue.

(7) As to the choice of an electrode for a given piece of work much might be said which does not fall within the scope of this paper. The medium size flat knife is the one most generally used. The right and left curette and the point are useful instruments. I would deprecate the use of the cautery in inexperienced hands upon the middle turbinated bodies with the same freedom as may be permitted upon the lower; for the former are much more delicate, and require careful handling also, on account of their anatomical relations. The anterior ends of the middle bodies are more often the site of disease than other areas, and the curette in careful hands may be used in the reduction of these parts. The point should be used in destroying the elevations and in interrupting the blood-vessels supplying their nutrition, in the condition known as follicular pharyngitis.

(8) The cautery electrode should be quickly removed from its point of application before the heat is turned off, otherwise it will adhere and the tissue will be torn. This applies more particularly to the lesser degrees of heat. It is also one of the uses of the cautery, as will be presently mentioned.

(9) Aside from precautions to be taken in the subsequent care of a cauterized surface within the nose, the appearance of

excessive dryness, especially upon the throat, should be considered as a contra-indication to the further use of the cautery.

(10) The use of the cautery in the nasopharynx or larynx should never be attempted by untrained hands. An effort to reduce enlargements of the posterior ends of the inferior turbinated bodies by introducing an electrode anteriorly is to be interdicted as a step in the dark. I have seen many instances of damage to the cushion of the eustachian tube as a result. The tip of an electrode must always be kept in plain sight. The hand holding the instrument must not be required to balance it, or be otherwise than perfectly free.

(11) Referring to the subsequent treatment of cauterized surfaces within the nose, it may be laid down as a general principle that such tissue should be allowed to take care of itself as far as possible. Accumulated secretion should be cleared away, as well for surgical reasons as for the patient's comfort; but rest is an essential factor in cautery results. When a crust has nearly separated, or is acting as a flap to obstruct free drainage, it is best removed with the electrode. The flat surface of the cold electrode is firmly laid against the crust, a dull red heat is turned on and shut off at once. The crust is thus made adherent to the electrode and will come away with it. There is thus rarely any damage done to the underlying tissue, which is frequently the case in consequence of forcible removal with the forceps. This is also the proper way to apply the platinum wire to the tonsils. It is operated as a cold snare until a firm pedicle has been obtained. A white heat is then turned on.

(12) When a cauterized part is in close proximity to another part, the two should be mechanically separated to avoid union by adhesion. As a wedge in the lower nares I use a section of a thick rubber strap, single or double, as required. For the space between the middle turbinated bodies and the septum I insert a section of suitable length of the rubber band used upon ordinary preserve jars, with the convexity upward. These bands should be kept in strong carbolic solution. They should be washed in sterilized (or "crystal" water) and dipped in an antiseptic oily preparation before being inserted. (*Clark.*)

Atrophic Rhinitis.—Moisten a felt-covered, flat electrode, about 3×4, in a one per cent. solution of bicarbonate of soda, connect it with the positive pole and apply it to the back of the neck. Cleanse the nasal cavities in the usual manner. Wrap a piece of absorbent cotton around the metallic end of a bifurcated electrode which can easily be improvised by bending a

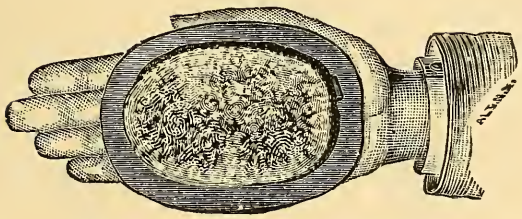


Fig. 413. Sponge-covered flat electrode.

piece of stout copper wire attached to the tip of the conducting cord connected with the negative pole, moisten these pledgets of cotton and insert the double electrode into the nasal cavities as far as is comfortable.

Gradually increase the current strength through the rheostat to a point short of producing pain, and usually from five to eight mil. is sufficient. In from five to ten minutes, according to the amount of irritation produced, lower the current to zero and withdraw the electrodes. Repeat three times a week until improvement ceases. This method is not disagreeable, and some cases respond to it promptly, while others improve slowly.

Nasal Catarrh. Subacute or Chronic Rhinitis. Ozœna. Chronic Pharyngitis.—*Metallic Electrolysis.*—Cleanse the nasal cavities in the usual manner. Spray sufficient 4 per cent. cocaine solution upon the mucous surfaces to be treated to produce moderate anæsthesia.

Apply a felt or sponge covered, flat electrode, about 3×4, to the back of the neck, and connect it with the negative galvanic pole. Moisten it thoroughly in the usual hot solution of soda bicarbonate. To the positive pole attach an insulating handle tipped with one of the largest sizes of short copper or zinc bulbs. Copper is generally employed.

Freshly brighten the surface with fine emery cloth previous to use on every occasion, even when the electrode is new and brightly polished. In the treatment of the nasal mucous membrane insert the tip to the posterior nares of one side and cautiously increase the constant galvanic current through the

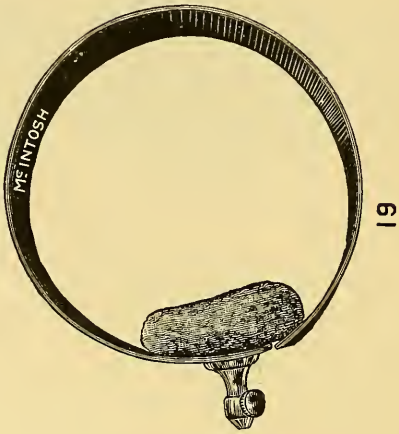


Fig. 414. Self-retaining neck electrode.

Fig. 415. Short copper or zinc bulbs.

rheostat from zero up to 5 or 7 mil. The tissues are extremely sensitive to the galvanic current even though protected with cocaine, and a current of only a little greater strength than may be tolerated with comfort may cause an intense and unendurable pain.

The current may be increased in some cases above 7 mil., but in all cases it should be reduced the moment it begins to be painful.

Keep the copper bulb in very gentle rotation and sliding movement over the mucous tissues of one side for about three to five minutes. The rotation and movement should be just sufficient to prevent the adhesion of the electrode.

Repeat the same process upon the opposite side.

Treatment of the Pharynx at the Same Sitting.—With the negative electrode remaining upon the neck sweep the copper bulb over the affected pharyngeal region with the

Fig. 416. Copper or zinc bulb.

Fig. 417. Copper tip pharyngeal electrode.

current increased to 12 or 15 mil. The electrode must be withdrawn as often as the comfort of the patient requires, as it will cause gagging, and prevent deglutition and respiration. Repeat the application however, during about five minutes, so that a sufficient amount of cupric electrolysis will be accomplished before desisting.

Before applying the electrode to each of these three situations it must be freshly brightened with the emery paper.

The application sets up a "substitutive inflammation" which must be allowed to subside before it is repeated. Repeat about once a week for one month and then once in two weeks for another month, or until the improvement is satisfactory. If the early applications are thoroughly made with a little more persistence and as much current as the cocaine will enable the patient to tolerate, it will be found that twice a week would be too often, and that once in from four to eight days suffices.

The patient is apt to be annoyed and kept awake the first night after the application, and a sedative hypnotic will do no harm and will make the patient grateful for the comfort it produces. A teaspoonful of bromidia with ten minimums of elixir McMunn in half a glass of water on retiring answers the purpose very well.

Immediately after the application and during the balance of the first day especially, and in a lessened degree throughout the following days during the entire course of treatment, the patient in private practice should be given a soothing solution to promote comfort. A saturated solution of boracic acid containing suitable proportions of hydrastis, hamamelis and glycerine is very satisfactory for this purpose. Instruct the patient to mix four drams in a cup of tepid water and snuff up each nostril and gargle the throat p. r. n. until the irritation of treatment ceases.

This method has been employed in this country since 1892. It is perhaps more effective than popular, owing to the care required to avoid pain during the application and irritation afterwards. It is however regarded by some as the nearest approach to a reliable and curative method of treating these affections. The principle is the same for all the above conditions and only needs to be modified in dosage and in the mucous surface treated to suit each particular case. A requisite preliminary to the application of the electrode is cleansing the surface so that the copper will be deposited within the tissues. I append a mention of German use of the same method by needle puncture.

Ozœna Treated by Puncture.—It is now three years since we commenced treating our different cases of ozœna by cupric electrolysis. We wish to insist only upon those facts which are proven. Some of our patients, who have been cured, remain under regular, periodical observation; there has been no relapse for months, and, in some of the first cases cured, for over three years. We think that no one can accuse us of precipitation in announcing a method of cure for so intractable a disease as ozœna.

For interstitial electrolysis are needed:

1. A source of constant electric energy.
2. A milliampere metre.
3. A rheostat.
4. Needles isolated by a bit of rubber drainage tube.

A needle of silver or copper is inserted into the mucosa of the middle turbinated bone, through the bone itself or else into its concave surface, which is usually the one affected. A

steel needle in the mucosa of the inferior turbinated bone of the same side, placed as nearly as possible between the mucosa and the osseous substance, and extending the whole length of the bone itself, completes the circuit. In those cases where there is a deviation of the septum we insert our negative needle there.

The nostrils to be operated upon are rendered anæsthetic with cocaine, and, as far as possible, aseptic; the needles are made aseptic by heat; the insertion of the needles and the passage of the electric current are both, in the great majority of cases, painless.

Some patients, however, complain of true hemicrania, or of a dull pain behind the eye, between the eyes, or at the nape of the neck; this may cause congestion of the conjunctiva and lacrymation. These symptoms may persist for several days. In most cases there is no appreciable trouble, but a sense of well-being comes on after the first few days, and with this, as a first symptom, the disappearance of the stench. Rhinoscopic examination shows the entire mucosa of the middle turbinated bone covered with a bluish green layer and the eschar of the lower turbinated bone does not extend to the mucosa. Repair is complete in from 12 to 15 days.

After cure, in recent cases, the mucosa regains all its characteristics; in severe cases a certain amount of atrophy persists. It seems incontestable that interstitial electrolysis instead of causing atrophy brings about a regeneration of the atrophied mucosa. There were 91 per cent. of cures. (*Cheval.*)

Bayer concludes an article on the cause and best treatment of ozœna as follows:

A. Ozœna is a trophoneurosis consisting of (1) an anomalous secretion of the mucous membrane of the nose, naso-pharynx and pharynx whose product serves as a culture medium for a microbe peculiar to ozœna, and producing the odor so characteristic of that disease; (2) a disturbance of nutrition, with atrophy of the mucous membrane; (3) a rhinitis, usually at first hypertrophic, which is brought about by the irritation of the secretory products, these acting as foreign bodies. *B. The best, one might say the specific, treatment of ozœna is by electrolysis*, which, however, is not absolutely free from danger.

Bayer insists on absolute cleanliness. The careful removal of all crusts and the frequent use of nasal douches of lukewarm water, or mild antiseptic solutions, precede the application of electricity. The positive pole, a copper electrode, is introduced into the nose, and by means of a relatively weak current and

oft-repeated treatment, this obstinate disease may be completely cured. He prefers a weak current as being safer than a stronger one, but its therapeutic action is slower.

The action of the electricity is threefold. First, the oxychloride of copper is set free into the tissues and produces chemical effects there. Secondly, the electric current has been asserted by some to be an active germicide. Thirdly, and upon this the author lays especial weight, by the "deep molecular disturbance" which the current brings about, the nerve-endings are affected, and as a result a trophoneurotic reflex-action is produced, more blood flows to the mucous membrane, the excretion becomes more fluid, and no longer furnishes a medium for the growth of the ozœna-microbes. Be the theory as it may, the results of this treatment were in every way satisfactory.

While the treatment of chronic rhinitis and ozœna by cupric electrolysis has been described above nothing has been said about the views of patients who are treated by this method. It is my own opinion that the general practitioner will not find it satisfactory. Patients do not like the pain and distress which follow the treatment, and the results do not excite enthusiasm among those who possess the "catarrh." While a few treatments are said to "cure," this has not been my own experience. Without cocaine-the treatment is so severe that few patients in private practice would tolerate it a second time. When cocaine is employed it is still far from pleasant. What the specialist in nose and throat diseases may be able to do with cupric electrolysis I cannot say, but believe that the average physician will usually find it discreet to treat the mucous membranes of the nose and throat by some other means.

Hypertrophy of the Nasal Septum.—*Galvanic.*—Place a felt-covered, positive electrode, about 3×4, on the back of the

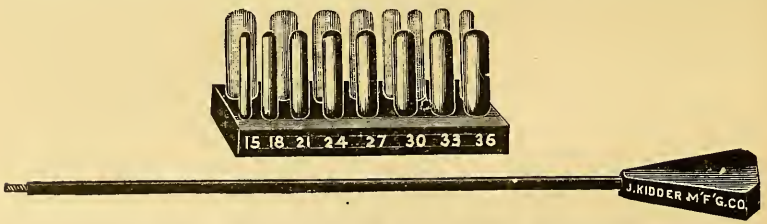


Fig. 418. Zinc—copper:—tips for metallic electrolysis.

neck. Apply to the hypertrophied tissues a metallic tipped electrode of suitable size, and connect it with the negative galvanic pole. Increase the current from zero up to tolerance and in five minutes reduce to zero. Repeat twice a week. A cleansing spray should be used before the application if the condition requires it, and in all cases exhibiting marked sensitiveness to the action of even a small current a cocaine solusion should be used to procure a tolerance of at least 7 to 10 mil.

Anosmia.—*Galvanic.*—If this condition depends upon any apparent lesion or catarrhal process, treatment will be governed accordingly. If it appears to be an uncomplicated symptom and the patient desires treatment it may consist of galvanic stimulation of the olfactory nerve.

Wrap a bit of absorbent cotton wet with warm bicarbonate of soda solution around two metallic tip electrodes and connect them with a bifurcated cord to the negative galvanic pole.

Fig. 419.

These may be inserted in the nostrils and supported in comfortable position by the patient. Place a positive felt or sponge covered electrode, about 3×4, upon the back of the neck and increase the constant current from zero until a gentle warmth is felt in the nose. In five or eight minutes reduce the current about one-half and end the sitting with a few sharp reversals of polarity, as strong as can be tolerated without discomfort.

Repeat every second day till improvement is noted, then three times a week till benefit ceases. If eight or ten applications do not afford encouraging results it will be generally useless to continue treatment.

CHAPTER LXIII.

ELECTRICAL TREATMENT OF THE THROAT.

Electricity in diseases of the pharynx. Anæsthesia. Hyperæsthesia. Paræsthesia Rheumatism and paralysis of the pharyngeal muscles. Chronic follicular pharyngitis. Chronic hypertrophy of pharyngeal tonsils. Diseases of the larynx from altered nutrition. Aphonia. Hoarseness of singers and speakers. Author's method of treatment.

Electricity in Diseases of the Pharynx.—This subject may be considered under the following heads:

1. Neuroses of sensation or motion.
2. Rheumatic affections of pharyngeal muscles.
3. Chronic follicular pharyngitis.
4. Chronic hypertrophy of pharyngeal tonsils.

Neuroses of the pharynx are indicated by anæsthesia, hyperæsthesia, paræsthesia and neuralgia of the parts.

Anæsthesia may be a symptom either of glosso-labio-laryngeal paralysis, or a result of diphtheritic paralysis, or is occasionally present in cases of insanity in which no paralysis exists in any other part of the body. The galvanic current regularly and persistently applied will frequently relieve this condition unless it is caused by bulbar paralysis.

Hyperæsthesia when dependent upon either hysteria or acute or chronic inflammation of the larynx offers, according to Shearer, no opportunity for electrical treatment of any kind, except in cases of chronic follicular pharyngitis, when applications of the galvano-cautery are often able to relieve the hypersensitiveness at the same time that the hypertrophic conditions are remedied.

In my own experience however this condition is almost invariably relieved by one of two simple means; a counter-irri-

tant static spray externally, or high-tension induction coil sedation.

Counter-irritant Spray.—Seat the patient upon the static platform in the usual manner and connect it with the negative pole if the neck is uncovered, or the positive pole if a collar of resisting material covers the neck. Sometimes I have a patient wrap a scarf of silk or wool around the neck to produce the effect desired.

Ground the opposite pole and the brass point electrode to the gas fixture. Start the machine into moderate action. Have the patient elevate the chin and turn it to the opposite side while the point is swept near enough to the surface to produce a mild counter-irritant and yet sedative effect. Continue the application for about three minutes and treat the surface at the back of the neck in the same manner. The relief of recent or temporary conditions is practically immediate, while chronic cases are improved gradually.

Faradic Sedation.—Moisten a pair of ordinary hand electrodes, connect them with the opposite poles of the high-

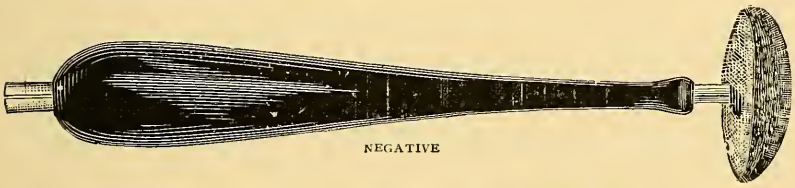


Fig. 420. Ordinary sponge-covered hand electrode.

tension induction coil apparatus and apply them to the sides of the neck with the positive over the most sensitive area. Switch into circuit the rapid interrupter, three or four cells and the combined short 36 and long 32 secondary coils. Gradually increase the current through the rheostat from zero until it produces a comfortable and firm grasp upon the muscular tissues. Maintain the action steadily for about ten minutes. Reduce to zero. Repeat p. r. n.

Paræsthesia.—Whenever the location of a hypersensitive

spot can be ascertained, direct and immediate relief is most usually secured by the application of the galvano-cautery. If the cautery cannot be employed treat as described under hyperæsthesia.

The Neuroses of Motion which the pharynx is subject to may be paralytic or spasmodic. The paralyses which affect the pharyngeal muscles may be dependent upon bulbar disease (in which case little can be done with electricity), may result from diphtheria (in which case the prognosis is good), or may complicate facial paralysis (in which case it does not require any special consideration, as the treatment of the greater lesion includes the less).

"Rheumatic affections of pharyngeal muscles are probably present in a large majority of the patients who consult the specialist for throat ailments. This is the case principally because of the severity and persistence of the symptoms, but also on account of the impression created in the mind of the sufferer that the pain must be indicative of some serious condition. The outset of these rheumatic sore throats is usually acute and of short duration, but from repeated attacks a chronic condition is finally produced." (*Shearer.*)

In such cases as have come into my own hands I have found necessary no other treatment than local counter-irritation with the static spray as described above for the treatment of hyperæsthesia. When the muscles of the neck, shoulders, pectoral region or back are affected entire relief is often afforded at each sitting of from five to ten minutes. After each sitting the pains only return with diminished severity and recovery rapidly ensues. Repeat daily.

Chronic Follicular Pharyngitis.—"Of all the applications recommended for local use the galvano-cautery is the best. It is clean, easily manipulated and can be quickly applied." In the exudative form of this pharyngitis where collections of drying or decaying secretions are found on the follicle we have the most difficult conditions to overcome; and it is in just such cases that the cautery point introduced into each

follicle at once removes the secretion and assists in causing contraction of the follicle. Not more than three or four should be treated at a sitting. In the non-exudative form the same application may be made with the same provision as to frequency and number cauterized at each sitting.

Draw the cautery point sharply across any enlarged blood-vessel which may be seen running into and apparently terminating in an enlarged follicle. so that the formation of a cicatrix will either reduce or obliterate the vessel.

Chronic Hypertrophy of Phiryngeal Tonsals.—The slower process of electrolysis does not in most instances pay for the time it consumes in dealing with these hypertrophies. In most cases of hypertrophy of the tonsils ablation is regarded as the most satisfactory treatment when it is considered practical and safe. Except in cases of impending asphyxia it is not advisable to operate until all inflammation has subsided.

In adults when the patient objects to a cutting operation, or when a fear of the possibility of hemorrhage exists, or when it is a diffuse flat tonsil, the electro-cautery is recommended as the best means of treatment.

The electrode is introduced cold into a crypt, and as the current is turned on the point is drawn toward the surface. This process is repeated with three or four neighboring crypts, thus destroying large portions of tissue. Shearer advises against both the galvano-cautery snare and what is called electro-cautery dissection.

In the tonsillar crypts are frequently found accumulations of a creamy white color which will vary from a caseous to a calcareous consistency. They often give a disagreeable odor to the breath. The best treatment is to remove them with forceps when possible and to cauterize the crypts in which they have been lodged with the electro-cautery to close the cavities and prevent repeated formation of the fungous masses.

Diseases of the Larynx from Altered Nutrition.—Garrison reports as follows:

All cases in which there is lack of nutrition of the laryngeal apparatus are proper subjects for this treatment. I have treated cases all along the line, from a slight muscular weakness of the larynx to a complete aphonia due to chronic catarrhal invasion, The method is simple.

Moisten a felt or sponge covered, flat electrode in a one per cent. hot-water bicarbonate of soda solution, connect it with the positive galvanic pole and apply it to the back of the neck. Secure a laryngeal nerve electrode to an interrupting handle, cover it with a piece of absorbent cotton, moisten it in the soda-bicarbonate solution and connect it with the negative pole.

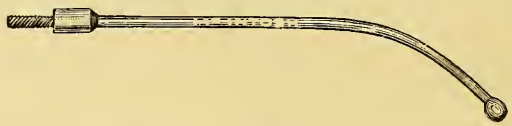


Fig. 421. Laryngeal electrode.

Adjust the current strength to about ten or fifteen mil. of the constant galvanic current. With the current at zero press the negative electrode upon the motor nerve and close the circuit through the interrupting handle about a dozen times at intervals of ten or twenty seconds. Repeat the sitting every second or third day until recovered. Our aim in all these cases is to promote nutrition, and this method is perhaps the best that can be devised for the purpose.

To place the negative electrode properly it may be stated that the recurrent laryngeal nerve ascends on both sides in the groove between the trachea and the œsophagus, and passing under the lower border of the inferior constrictor muscles enters the larynx behind to the articulation of the inferior corua of the thyroid cartilage with the crycoid cartilage, at which point it can be easily reached by carefully pressing the electrode around the larynx with the one hand, the other hand supporting it upon the other side." (*Garrison.*)

Aphonia.—Cases of simple aphonia or hoarseness which improve in summer and are worse in winter without local disease may be treated with good results by both galvanic and rapidly interrupted induction coil currents. They may also be successfully treated with the static spray and mild spark.

Galvanic.—Place a positive felt-covered, flat electrode, about

3 × 4, upon the back of the neck. Bend a flexible electrode over the larynx so that it covers both sides. This may be lined with soft sponge or felt. Moisten both electrodes thoroughly in hot soda-bicarbonate solution. Increase the constant galvanic current from zero to about 15 mil. and continue for ten minutes.

Next apply two similar small sponge-covered hand electrodes to the opposite sides of the larynx and connect them

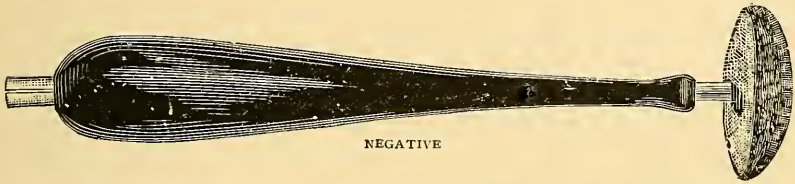


Fig. 422. Ordinary sponge-covered hand electrode.

with the terminals of the galvanic battery without regard to polarity. Switch the automatic rheotome into circuit and adjust it to about 70 interruptions per minute. Regulate the current so as to cause moderately strong contractions through the vocal apparatus for two or three minutes.

Repeat these applications three times a week until sufficient improvement is obtained.

Faradic.—In recent cases, and in chronic cases after five or six applications of the galvanic current, employ only the high-tension induction currents from either the coil apparatus, or Leyden jars and the static machine.

Apply ordinary, sponge-covered hand electrodes to the opposite sides of the larynx so that they are about one inch apart in front. Switch the 1,500 yard No. 36 coil, rapid vibrator and three or four cells into circuit. Increase the current from zero through the rheostat, until it is strong enough to produce a sensible but painless grasp upon the tissues. Then switch to the slow vibrator adjusted to 70 interruptions per minute and exercise the throat muscles vigorously, but short

of fatigue. The tolerance to exercise will increase during the course of treatment. Duration of entire sitting ten minutes.

Repeat three times a week.

Very rapid relief will be obtained in recent cases, and in mild acute cases I have seen one or two applications remove the trouble entirely. In chronic and neglected cases several weeks or even several months of treatment may be required, and in old incurable cases an improvement of about 50 per cent. may be obtained.

Aphonia from Thyro-arytænoid Unilateral Paralysis.—Mr. V., aged twenty-two years, a salesman in a bicycle store, in April, 1896, started on a trip a distance of sixteen miles, with two experienced bicycle riders. When he reached the destination he fell from his wheel and almost collapsed. He was overheated, being drenched with perspiration. In this condition he drank a quart or more of water. A heavy cold followed, and he was confined to bed for over two weeks with laryngitis and gastritis. The latter occasioned frequent vomiting. During all this time his voice was lost, which was attributed to acute laryngitis. He recovered his physical health fairly well in about a month and returned to work, but was of little use as a salesman, with only a whispering voice. Then the writer was consulted. The laryngoscope showed congestion and infiltration of the larynx, particularly the arytænoids. The left vocal cord failed to approximate by an eighth of an inch on attempts at phonation. The unmolested right vocal chord not only came to the median line, but went slightly beyond it on attempts at phonation.

Treatment.—Strychnine, in pill form, commencing with a tenth of a grain daily, which was soon increased to a third of a grain daily. The faradic current of electricity was applied for ten minutes daily by sponge electrodes. The anode over the larynx and cathode to the nape of the neck and the side of the larynx. A spray consisting of ten grains of zinc sulphate to the ounce of water was used daily on the pharynx and larynx, also a spray of albolene with a little carbolic acid and Eucalyptus. Under this treatment the voice had greatly improved in three weeks, and fully recovered in six weeks. (*McCassy*).

Pharyngitis, Laryngitis, Voice Fatigue or Hoarseness of Singers and Speakers.—In these cases, where the trouble is

chiefly congestion or fatigue of the vocal apparatus and the voice becomes thickened and husky or loses in any respect its tone or controllability, both the high-tension induction coil and the static machine afford excellent methods of treatment.

If the static machine is used I insulate the patient negatively and send a few sharp, thick positive sparks to each side of the larynx, with the patient's chin well up and turned to the opposite side. Use care to avoid sparking the chin or the sensitive regions of the upper part of the chest. Next apply a few similar sparks to the cervical spine. An alternative method employs Leyden jars.

Place the small Leyden jars in circuit and press an ordinary hand sponge-covered electrode moistened with hot water to each side of the larynx externally. Place the sliding poles of the static machine in close contact. Start the plates into rapid action and draw the poles gradually apart until the muscular effect is as strong as possible without producing discomfort or preventing the patient from swallowing and breathing.

During the passage of the current put the vocal cords into action by requesting the patient to practise deglutition, inaudible sounds or even the vocal scale aloud.

After from three to five minutes of this continuous application of anti-congestive, sedative-tonic current through the vocal apparatus reduce the dosage about twenty per cent. and then institute a series of rising current waves, by suddenly increasing the spark gap to the utmost limit of tolerance and instantly decreasing it again.

Twenty or thirty such rhythmical impulses may be sent through the tissues in two or three minutes. Then let the machine come to a gradual stop, and while the spark stream loses its high frequency there will be a gentle exercise of the throat muscles as the interruptions of the current become slower and slower till they finally cease.

Repeat as needed in acute cases, relief being very speedy.

In chronic cases the first sittings should be daily, with later repetitions regulated by the circumstances of the case.

The Leyden-jar method is a favorite with the author, and achieves such gratifying results that patients as a rule are delighted. As a means also of preserving a failing voice which is still the owner's dependence for support, this tonic application repeated for a few times as often as the need arises would put off the evil day for a long time. From operatic stars to choir singers, and from dramatic and political to pulpit orators, there are many who would rejoice to know of so valuable and swift a remedy for any temporary strain upon the voice. If the throat specialist has anything to offer in similar cases that can compare with the efficacy of this method I am not aware of it.

To the worried and alarmed singer, fearful of pecuniary loss and unable by desperate efforts to command the vocal chords, the static electrodes appear to be the wonder-wands of magic. The current, however, simply relieves congestion, restores tonicity to the muscular fibres, and the voice revives again. In such cases, also, whenever the general health and especially the nervous system is below par, the *prima donna* or the humble but necessary singer in the chorus or choir may easily receive the usual benefits which positive static electrification bestows upon all who require its tonic action.

Chronic Voice Fatigue.—Mr. D——, aged 50, sings in a choir regularly. Has done so since boyhood. During the past year or two has noticed that his voice has begun to show wear. He was treated with the Leyden-jar method, which I generally employ instead of the sparks. The immediate improvement in his voice was noticed by his choir leader the next day. He was treated a few times with increasing improvement, and when his voice fails again he will return.

He was not only delighted but surprised at the remarkable benefit which his voice obtained so rapidly and so easily, and he remarked, as others always do, that if persons who use their voice as a means of support were aware of the existence of such

a practical remedy for functional derangements they would all be glad to utilize it.

Mr. S——. Acute laryngitis of mild form with partial aphonia. Could hardly talk above a whisper and voice was so husky that he said he thought he had "caught cold." He was treated for five minutes in the usual manner, with the rapidly interrupted high-tension current, and as he then appeared able to talk with very nearly a natural voice no other treatment was given. Two weeks later he returned with a recurrence of the same cold from exposure to wet weather, and the same treatment acted as before.

The following relates my experience with a chronic and probably incurable case:

Miss ——, aged 20, anæmic, had adenoids removed two years ago. Has a chronic catarrhal pharyngitis, has been hoarse since she was about three years of age. Has no special symptomatic derangement. Has been taking vocal exercises from a celebrated music teacher, who assured her that he could cure her voice, but the strain makes it worse.

She has been treated locally and generally in a number of different ways by different physicians, but her voice, at the time of her coming to me, was extremely husky and possessed very little power. It was a source of mortification to her, and treatment was begun with general static electrification and continued with alternations of both the spark and Leyden-jar current to the larynx.

After the earliest application she felt a choking sensation, which presently passed off, but benefit did not begin to appear until the fifth treatment. At the tenth treatment the voice was much less guttural. On the sixteenth visit she appeared as hoarse as ever and had myalgia of the right shoulder, the effects evidently of a sleigh-riding party which she had participated in two days before. The static application removed both the myalgia and the extra hoarseness.

At the eighteenth visit she appeared to have gained considerably, her voice was much clearer and she was pleased and hopeful. At the twenty-second visit my entry reads: "Voice improves steadily, cannot do scales without the current as it chokes her, but with the electrodes applied and the current passing she can practise scales loud and clear; is very much better."

At the twenty-ninth treatment her voice was quite smooth and clear, she could take high notes with the aid of the current

very well, and she concluded that her total improvement was equal to about sixty per cent.

Between the 19th of January and the 6th of April, 1894, she received thirty-eight applications, during which time she sometimes improved and sometimes relapsed. She then went abroad for a year, and on returning I learned that the improvement had remained about the same. During the middle portion of her treatment a few intercurrent applications of a mild galvanic current were administered to relieve the monotony of action upon the tissues.

The following case reported by Dr. Caldwell expresses in a few brief words the ordinary experience of physicians who possess static machines:

About two years ago a prominent baritone singer was sent to me for electrical treatment, suffering from paralysis of the right vocal cord. My treatment consisted of negative sparks on the cervical region for five minutes and on the larynx for four minutes. A few such applications restored the vocal cord and his voice to their normal condition.

Favorable Effect of Franklinization on the Voice.—It was announced at the meeting of the *Acad. des Sciences*, April 5, 1897, that the singing voice after a course of Franklinization, if the vocal organs are sound, becomes clearer, more flexible, with increased volume and agreeability of tone, and is less easily fatigued. It is therefore to be recommended to vocal pupils and *débutants*, as it imparts an exceptional beauty to the voice. The singer is seated on an insulated stool, connected with the negative pole of a high-tension static machine, and an electric brush held before his face. The effect is perceptible even after one sitting.

CHAPTER LXIV.

GALVANIC AND FARADIC CURRENTS IN SKIN DISEASES.

Neuroses of the skin. Acne rosacea. Treatment of a red nose. Cosmetic effects upon pale and hollow cheeks. Circumscribed dermatalgia or hyperæsthesia of the skin. Tinea. Felon. Secondary syphilitic and other eruptions in which germicidal infiltration is indicated. Barber's itch. Fissure of any mucous membrane. Benign vascular tumors. Benign tumors of the breast. Small vascular nævus. Corns and callosities. The removal of warts. Keloid. Dermatitis, acute sunburn, etc. Chilblains. Treatment of chronic ulcers. Ganglion. Bubo.

Neusoses of the Skin.—In affections of the skin in which pruritus or pain is present there is often an eruption or local condition which renders the application of galvanic and coil currents disagreeable to the patient. The local application of some form of current which will relieve the pain or itching after ointments and lotions have failed is often of great value to correct interference with sleep, digestion and nutrition.

Seat the patient upon the static platform connected with the negative pole. Ground the positive pole and the brass point electrode to the same gas fixture. Remove all woollen or resisting clothing over the affected parts. It is not necessary to remove muslin or cotton undergarments, but the desired sedative and cooling qualities of the application will be destroyed by resistances which set up heat.

Start the machine into moderate action, and with gentle to-and-fro movement of the electrode apply a strong breeze persistently over the affected parts until relieved. The distance between the point of the electrode and the surface of the body will vary from two to five inches according to the speed of the revolving plates and consequent activity of the current.

The application may require three, five or ten minutes, but persist until sedation is complete.

Repeat p. r. n., or daily at first, and as benefit progresses lengthen the interval between sittings until relief is established. After a few sittings intersperse mild sparks from the point of the electrode, but close the sitting with the sedative breeze.

Acne Rosacea.—The principle of treatment is about the same as that for vascular nævus.

Moisten an ordinary sponge-covered hand electrode in the usual solution of bicarbonate of soda, connect this with the negative pole of the galvanic battery and have the patient hold it.

Next arm a needle-holder with an iridio-platinum needle and connect it with the positive pole. With the patient in a good

Fig. 423. Assorted needles.

light insert the platinum needle into any one of the dilated blood-vessels so as to transfix the walls. After the needle is inserted request the patient to make contact with the negative electrode at any convenient place as near the needle as possible. The side of the neck or face, if these are not covered with hair, is usually convenient,

Pass a current strength of from one to two mil. for a moment until evidence of sufficient electrolytic action is seen. Immediately have the patient remove the hand electrode.

Select another point at a little distance from the first puncture and repeat the process. After several punctures, or as soon as the patient complains of the irritation, close the sitting for the time. Repeat the process twice a week until the vascularity of the affected area is destroyed. Then attack the hypertrophied

tissue with negative electrolysis to promote absorption and reduce the deformity. The process is exactly the same except that the needle is connected with the negative pole and is inserted more deeply into the tissues.

Allow several months for the completion of the effects of electrolytic treatment in any difficult case.

Red Nose.—Patients occasionally are annoyed by mortifying redness of the tip of the nose especially aggravated by coming into a warm room from cold air. The nutrition of the parts and tonicity of the blood-vessels may possibly be improved in any individual case by passing the galvánic current directly through the parts.

Select two ordinary sponge-covered hand electrodes of small

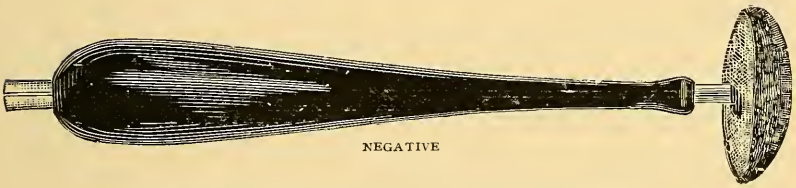


Fig. 424. Ordinary sponge-covered hand electrode.

size, moisten them in a hot-water solution of bicarbonate of soda and apply them to each side of the nose. Increase the constant galvanic current from zero up to the point of tolerance. In about five minutes reduce to zero. At different sittings reverse the polarity. If irritation occurs after treatment allow it to entirely subside before repeating. Repeat at intervals of two or three days until improvement is satisfactory. From ten to thirty treatments may be required.

Cosmetic Effect upon Pale and Hollow Cheeks.—Moisten a felt or sponge covered electrode of medium size in a one per cent. solution of bicarbonate of soda, connect it with the positive pole of the galvanic battery and place it upon the back of the neck, where it can be easily retained with firm pressure by a band held by the patient. Moisten two ordinary hand electrodes in the same hot-water solution, connect them by a

bifurcated cord with the negative pole and press one upon each cheek.

Gradually increase the constant galvanic current to about 8 mil., or sufficient to produce a sense of warmth in the tissues. During about ten minutes move the negative electrodes very slowly about over the sides of the face. This draws the blood to the surface, reddens the skin, increases nutrition, and in time fills out the sunken cheeks. At the close of the galvanic application transfer the conducting cords to the induction coil apparatus with the same electrodes as before. Switch into circuit the 800 yard No. 32 coil, three or four cells and the slow vibrator adjusted to about 100 periods per minute. Regulate the current strength so as to cause efficient and agreeable contractions of the cheek muscles and thus aid in their development.

By this method with from four to six applications per week very gratifying results can be accomplished in about a month. It far surpasses ordinary facial massage although the latter can be added to the electrical treatment if desired.

Attend to the general health also by suitable measures. In addition to tonic and nutritional remedies aid will be obtained from static electricity.

Circumscribed Dermatalgia or Hyperæsthesia of the Skin.—Effective sedation is accomplished by the rapidly interrupted high potential current of either small Leyden jars or the author's improved induction coil apparatus.

Select two ordinary sponge-covered electrodes, moisten them in hot water, connect them to either the static or coil terminals (whichever the operator possesses), and apply the positive upon the site of pain and the negative opposite. Regulate the current strength to the maximum of tolerance without causing discomfort. Length of sitting may be five or ten minutes. Repeat daily until relief is determined and then p. r. n.

In a recent case of this kind complicating sciatica the peculiar dermal pain was over a callus following a former injury of

the knee joint. An area the size of the palm was sensitive to the slightest touch and particularly at night. Firm pressure was agreeable. The sciatica was entirely relieved in a week, but similar treatment had no effect upon the localized hyperæsthesia.

A single tentative application of the galvanic current was then made without effect. At the next sitting the application was made with small Leyden jars and the static machine. Relief was felt in three minutes. The application was continued three minutes longer and relief lasted the balance of the day. At each successive treatment the benefit lasted greater length of time, and after the fourth treatment the patient declared himself free from pain for the first entire 24 hours in six months. He has remained well since the tenth treatment.

Tinea.—Cleanse the surface to be treated of crusts, scales and sebaceous matter. Moisten a layer of absorbent cotton in a one to one thousand solution of bichloride of mercury with a pinch of bicarbonate of soda added. Place this upon the affected region and apply upon it the base of any electrode of suitable size, connected with the positive pole of the galvanic battery.

Select a larger felt-covered, flat electrode, moisten this in the usual (one or two per cent.) hot-water solution of soda bicarbonate and apply it to any convenient place near the positive electrode, usually the back of the neck for all cases affecting the scalp.

Gradually increase the constant galvanic current through the rheostat from zero up to 8 or 10 mil. After about ten minutes reduce the current to zero and close the sitting. Repeat daily until improvement is established.

Cupric Electrolysis.—Proceed as above described but substitute for the *merc. corr. cataphoresis* the largest of the set of copper tips provided for *cupric electrolysis.* Connect this with the positive pole of the galvanic battery, freshly brighten it with fine emery paper, moisten the surface of the lesion with a pledget of cotton dipped in the bicarbonate of soda solution

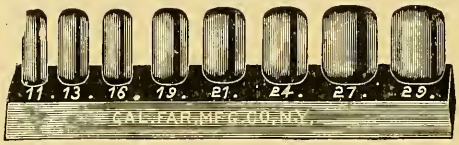


Fig. 425. Short copper or zinc bulbs.

with which the negative electrode was moistened and apply the copper tip to the surface. Gradually increase the constant galvanic current from zero up to about 7 mil. and maintain the action of the current for eight or ten minutes over every part of the affected surface until it is thoroughly coated with a deposit of oxychloride of copper. After the sitting protect the surface with a dry dressing and await results for about ten days, when a second application may be made if required.

Felon.—In the early stage before suppuration the following methods may be employed.

Galvanic.—Take two ordinary tumblers and fill both with the usual hot-water solution of bicarbonate of soda—one or two per cent. In one tumbler sink the tip of the cord connected with the negative pole of the galvanic battery. In this tumbler immerse the sound finger next to the felon.

To the other glass add bichloride of mercury sufficient to make a one to one thousand solution. In this tumbler sink the positive cord tip and immerse the affected finger.

Fig. 426. Water-bath electrode.

Gradually increase the constant galvanic current from zero up to about fifteen mil. In about ten minutes reduce gradually to zero. Dry and paint the skin over the felon with collodion. Open the bowels freely with a saline laxative, and if there is insomnia from pain prescribe a temporary anodyne. In a few days a favorable result may appear from a single treatment of this kind.

Faradic.—The application of the faradic current, the positive pole to the affected thumb or finger, for ten or fifteen minutes, will allay the pain and inflammation. The application should be repeated the next day, and perhaps a third treatment on the following day may be necessary. This treatment in my hands has been sufficient to cure several cases after the parties had lost several nights' sleep on account of the pain, and had been advised to have the finger opened to the bone. (*East. Me. Jour.*)

Secondary Syphilitic and other Eruptions in which Germicidal Infiltration is Indicated.—Arm the cataphoric electrode with fresh blotting-paper, saturate it with a one to one thousand solution of bichloride of mercury (with about one per cent. of bicarbonate of soda added) and connect the electrode to the positive pole of the galvanic battery.

Fig. 427. Reservoir cataphoric electrode.

Moisten a felt or sponge covered, flat electrode about the size of the palm of the hand in the usual plain solution of soda-bicarbonate and apply it in the most convenient situation upon the sound skin near the local lesion. Connect this with the negative pole. Press the cataphoric electrode firmly down upon the point of eruption and gradually increase the constant galvanic current from zero up to about 15 mil. After five minutes increase to 20 mil. if tolerance will permit and in a moment reduce again to 15 mil. After about ten minutes gradually reduce the current to zero, remove the electrodes,

dust the surface with any antiseptic powder and close the sitting.

Before applying the electrode to the eruption it may be washed with hot water and soap for a moment to reduce the resistance. Prescribe appropriate medication, especially if the case is specific, and repeat the *merc. corr. cataphoresis* every second day until improved.

All these cases, of whatever variety, may be beneficially treated by merc. corr. cataphoresis. The parasiticide action of the mercury is enhanced by driving it into the skin. It aids materially in quickening the process of cure. Its rapid action may often be of great service to the patient. Each point of eruption must be covered by the positive electrode, and if the area is comparatively large the electrode (freshly moistened) must be moved from place to place until the whole surface is treated or else a larger electrode must be improvised.

The principle of the method is the same in all cases whether the eruption be papular, tubercular or gummatous, and regardless of the differential terms of nosology employed in designating the skin diseases due to germ action.

Barber's Itch.—Saturate a felt-covered, flat electrode, about 4×4, in the usual hot-water solution of bicarbonate of soda and connect it with the negative pole of the galvanic battery and apply it with firm contact to the back of the neck. Freshly

Fig. 428. Felt or sponge covered flat electrode, assorted sizes.

brighten a copper needle with fine emery paper and connect it with the positive pole. Press the point of the needle into a papule, raise the constant galvanic current from zero to be-

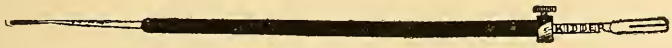


Fig. 429. Needle with adjustable sheath for puncture metallic electrolysis.

tween one and two mil., and in a moment, after distinct green discoloration appears around the needle, reduce the current to zero. If the needle adheres loosen it by reversing the current.

Treat ten or more papules in the same way at a single sitting according to the convenience of the patient. Repeat sittings every second day until the entire area has been treated. Await results, and after two or three weeks repeat the process with any remaining papules that require it.

Fissure of any Mucous Membrane.—Wash the surface of the fissure with any antiseptic solution. Moisten a felt-covered, flat electrode, 4 x 4, in the hot-water bicarbonate of soda solution, connect it with the positive pole of the galvanic battery and apply it to the most convenient situation related to the fissure. If the anal mucous membrane is the site of the lesion the positive electrode may most conveniently be placed under the sacrum with the patient in the dorsal position on the operating table.

Select any electrode with a metallic tip of suitable size, connect it with the negative pole and apply it to the surface of the fissure. Gradually increase the constant galvanic current from

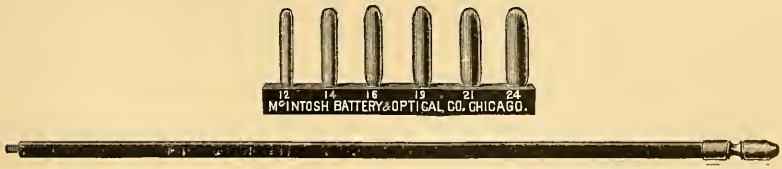


Fig. 430.

zero to about 10 mil. and slowly manipulate the electrode over the surface until all the fissure has been thoroughly attacked. In about ten minutes reduce the current to zero and close the sitting.

Simple auxiliary precautions required will be governed by the situation of the lesion. A single application will often be effective, but in a more obstinate case the same method may be employed a second time after a week or ten days. In ordinary cases no other method of treatment can compare with this.

Benign Vascular Tumors.—Moisten a felt-covered, flat electrode, 4 x 4, in the usual hot-water solution of bicarbonate of soda, connect it with the negative pole of the galvanic battery and apply it to the most convenient part of the body near the tumor. Select a needle of iridio-platinum, connect it with the positive pole and transfix the base of the tumor.

Fig. 431. Assorted needles.

Gradually increase the constant galvanic current according to the size of needle and tumor, the tolerance being proportioned to the area of contact. Small needles will carry only a small amperage of one or two mil. With larger needles three or five mil. may be employed. In a moment or two as soon as action is seen to have proceeded sufficiently reduce the current to zero. If the patient is timid employ previous cocaine anæsthesia to avoid the slight amount of pain created by the application.

The wound is aseptic and requires no special dressing. Await result of a single puncture. Repeat in two or three weeks if further action is necessary.

Benign Tumors of the Breast.—When surgical interfer-

ence is either refused or not important the patient should always be given the benefit of an attempt at electrolytic dispersion, especially if the diagnosis is in doubt.

Reduce the resistance of the skin over the tumor by a thorough shampoo with hot water and soap. Shape a felt-covered pad electrode to cover the affected parts, moisten it thoroughly in a two per cent. hot-water solution of bicarbonate of soda, press it firmly upon the site of the tumor and connect it with the negative galvanic pole. If the tumor is small the positive electrode may be placed upon the back of the neck or at any convenient situation, but if the tumor is large, hard and old, requiring currents of large amperage, a large area of contact for the positive current is essential to the comfort of the patient.

In this case remove the shoes and stockings and immerse both feet deeply in a large pail of warm water plus two teaspoonsful of soda-bicarbonate and immerse both hands in deep jars filled with the same solution. Into these water-bath electrodes sink the tips of wires connected with the positive pole and protect each tip from touching the patient's skin.

Gradually increase the constant galvanic current through the rheostat until it begins to produce decided sensation at the negative pole. Pause a moment until the sensation dies away, and again advance by successive steps until the greatest possible current is developed.

This will of course depend upon the area of the electrode over the tumor, and will vary between 50 and 100 mil. if the positive contact is large enough to tolerate large amperage.

After about fifteen minutes reduce the current gradually to zero. After removing the electrodes dust the skin with a cooling powder and employ every precaution to protect it from irritation, for if the skin over the tumor loses its tolerance the applications will be interrupted until a normal condition is restored. Repeat three times a week, or as often as the condition of the patient will permit, and if improvement is observed continue the applications until final absorption is secured.

If no improvement follows a reasonable number of treatments the question of diagnosis should be seriously considered, for carcinoma may be suspected from the failure of negative electrolysis.

It is hardly worth while to attempt the cataphoric diffusion of iodine in cases of this kind, although many suggestions to this effect have been made.

Small Vascular Nævus.—Cleanse the part. Take two sharp new steel needles, fix in proper holders and connect one with the positive and one with the negative pole of the galvanic battery. Insert the positive needle-point into the nævus diagonally through the skin. Insert the negative needle about half an inch away into the place of vascular supply. Lift up the skin from the underlying tissues by lifting up the needles, and pass a constant galvanic current of two or three mil. for about one minute, or until the negative needle blanches the tissues and the positive coagulates and changes color,

Reduce the current to zero and remove the negative needle. The positive will be stuck fast. Substitute for the negative needle an ordinary hand electrode pressed upon the skin near the nævus. Reverse the polarity so that the positive needle becomes negative and pass a current of about one mil., until the needle loosens and comes out easily. Throw both needles away after once using.

Some pain will be felt, the part will be black and blue, and serum will ooze from the puncture for some time. The comfort of a private patient may be considered by first using cocaine, and after the sitting applying a sedative lotion to reduce the swelling and ecchymosis.

One sitting usually suffices, but one, two or three months' time will be required by nature to complete the process of restoring the tissues to nearly normal, for all galvanic burns heal slowly. By this method care must be taken to avoid extreme electrolytic action and an objectionable scar.

Warts.—While preparing apparatus place a pledget of absorbent cotton wet with hot alkaline water upon the wart to

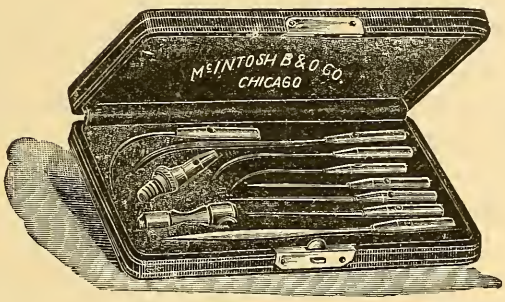


Fig. 432. Set of assorted needles for electrolytic work.

soften the tissues. Place a positive felt-covered, flat electrode, about 3×4, on any convenient situation near by and insert a sharp flat Hagadorn needle through the base of the growth. Connect the needle with the negative pole of the galvanic battery. Carefully increase the constant galvanic current through a rheostat from zero up to about 2 mil, and when electrolytic action has visibly taken place for about a minute reduce the current to zero and withdraw the needle. Time completes the process.

It is but slightly painful, and in the case of an unusually large or sensitive growth local anæsthesia could of course be first secured. After several months the cicatrix will be scarcely visible.

Remarks.—To remove small superficial growths of the skin or mucous membranes such as nævi, warts, fibrous and hairy growths, polypi, etc., no other method can compare with the subcutaneous insertion of a negative needle and galvanic electrolysis. The hurt is trifling, the cicatrix is either *nil* or merely nominal if properly done, and one puncture suffices for most of the smaller growths.

Corns and Callosities.—These may be removed by negative electrolysis in the same manner as warts.

Soak the corn in hot alkaline water while preparing for treatment. Press the foot upon any ordinary felt or sponge covered, flat electrode saturated in a one or two per cent. solu-

tion of bicarbonate of soda and connect it with the positive pole of the galvanic switchboard. Lift the corn and insert under the skin a sharp flat Hagadorn needle secured in any conducting handle and connected with the negative pole.

Carefully increase the constant galvanic current from zero to about 3 mil. and observe the electrolytic action. In about two minutes reduce the current to zero. Time completes the process.

Dr. Patterson reports: "I removed two soft corns from the feet of my wife, passing the current until the corns were perfectly white. These turned black in forty-eight hours, and in the course of a week a dry hard plug dropped out and the cavity healed perfectly smooth.

Keloid.—When deformities of this nature are not suited to operative treatment some improvement can be effected by persistent applications to the general surface. A child with irregular scar tissue upon both sides of the face resulting from a severe burn was treated in the manner described below:

Select two similar felt-covered, flat electrodes of a size cover-

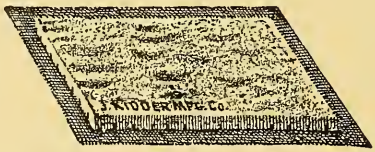


Fig. 433. Fine felt or sponge covered electrode—assorted sizes with soft rubber insulating backs.

ing the area to be treated. Wet these as usual in hot-water solution of bicarbonate of soda, press them moderately dry and then moisten them with 1–1000 solution of bichloride of mercury. Connect the electrodes with the opposite poles of the galvanic switchboard and apply one upon each side of the face.

Increase the constant galvanic current from zero up to 7 or 10 mil. In three minutes reduce to zero, reverse polarity and again increase the current. Repeat these reversals twice during a total sitting of twelve minutes. Remove electrodes and

dust the surface with toilet powder. Repeat every second day for at least three times a week.

Improvement will be very slow, and it is only in cases in which the patient has a strong desire to have appearance improved that six months or more can be devoted to a method of this kind. The net result may be a gain of about fifty per cent., but whenever plastic operations can do better they should be given preference.

Dermatitis, Acute Sunburn, etc.—Wrap the affected surface in a gauze bandage wet with bicarbonate of soda solution. Outside of this apply a large electrode connected with the positive pole of the high-tension induction coil apparatus, or if the arm is the part affected immerse the hand and forearm in a jar of water into which the tip of the positive conducting cord is dropped.

Apply a negative felt or sponge covered, flat electrode upon the back of the neck or any other convenient situation upon normal skin.

Switch into circuit the 1,500 yard No. 36 coil, the rapid vibrator and three or four cells. Regulate the current strength to a sedative dosage, just sufficient to produce a slight grasp upon the tissues, and maintain the action for from 10 to 15 minutes. Relief begins at once. Repeat p. r. n. After treatment prescribe any dusting powder or dressing which may be indicated by the degree of inflammation.

Chilblains.—Moisten a felt-covered, flat electrode, 6×9, in a one or two per cent. hot-water solution of bicarbonate of soda, connect it with the negative pole of the galvanic battery and have the patient sit on it.

To a basin nearly full of hot water add a teaspoonful of bicarbonate of soda and sink into the solution the tip of the positive conducting cord. Immerse both feet (if both are affected) in the basin and gradually increase the constant galvanic current from zero up to 7 or 10 mil. In a few moments as the sedative effect reduces the burning and irritation increase the current very gradually until it is again up to

the point of tolerance. After about fifteen minutes gradually reduce to zero. Repeat daily for a week and afterwards p. r. n.

The high-tension rapidly interrupted induction coil current may be employed in exactly the same manner or by a hand electrode passed slowly over the surface.

The positive static breeze applied directly upon the uncovered skin and gradually increased to a strong spray may also be employed.

The patient will go to bed and sleep sweetly all night. The next evening he will find the feet less sensitive, less painful and with very little itching. I have tried it on many cases a few of which were very severe, and I have never known one that was not cured.

M.—Had suffered for many years from chilblain caused from exposure when a child. She would sit for hours in the most acute agony and rub the foot where the cloth had touched it until the whole skin came off. She has tried every physician whom she thought would give her relief, with little or no help. Some six years ago I tried the galvanic current on her feet. It worked like magic. The burning and itching left in a few moments and she had a good night's rest. I repeated the dose every night for ten days, and since that time she has never once spoken of painful chilblains.

G. A.—A few years ago was nearly frozen to death. His feet were so badly frost-bitten that every winter he would be helpless for two months or more. I applied the galvanic current for 20 minutes each evening before bedtime and cured him. It acts like tannic acid on the tender flesh, hardens the skin and renders it tough yet pliable. (*St. Clair.*)

Chronic Ulcers.—These may be stimulated to healthy granulation by applications of static sparks or by the application of negative galvanic currents frequently recommended.

Static.—Seat the patient upon the static platform connected with the negative pole. The ulcer need not be unbandaged nor touched by the physician in any way, and this is the decided advantage in the employment of this method. Ground the positive pole and the brass point electrode. Start the machine into moderate action and sweep the point sufficiently

near the surface to produce a mild stimulating spray. The degree of stimulation is controlled by the operator to suit the indications of the case. By sweeping the electrode a little nearer the surface a few mild sparks may be added to the spray, and if the surrounding tissues are indurated these may be attacked with stronger percussive sparks by means of the brass ball electrode. Repeat daily or every second day for a short time. Continue the ordinary local care of the ulcer.

Galvanic.—Wet a layer of absorbent cotton in any antiseptic solution with two per cent. of soda-bicarbonate added. Apply this over the ulcerated surface. Connect a metallic electrode of suitable size to the negative pole and place it on the cotton.

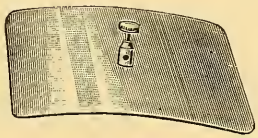


Fig. 434. Abdominal plates—various sizes.

Connect any hand electrode to the positive pole and place it over the nearest large vascular and nerve trunk. Pass a very mild constant galvanic current, 3 to 5 mil. for ten minutes. Repeat a few times p. r. n.

Ganglion.—Moisten a felt or sponge covered, flat electrode, about 4 × 6, in a one or two per cent. hot-water solution of bicarbonate of soda, connect it with the positive pole of the galvanic battery and rest the palm of the hand firmly upon it. To the negative conducting cord attach a needle-holder armed with a sharp surgical needle (steel) insulated within a quarter

Fig. 435.

of an inch of the point. Insert the needle through the skin and into the cyst. Increase the constant galvanic current

gradually through the rheostat from zero up to the point of tolerance. After a few minutes again increase the current. The dosage, whether 7, 10 or 15 mil., must depend upon the comfort of the patient. In about ten minutes reduce to zero. Repeat once or twice if needed at intervals of four days.

It is a nice operation leaving no scar nor any discoloration. The wrist will be the same as the other. It gives little or no pain and the patient will be more than pleased. (*St. Clair.*)

Bubo.—In any ordinary case prior to suppuration supplement the usual compression bandage, etc., by the powerful vaso-constricting, anti-congestive, alterative and nutritional actions of the rapidly interrupted high-tension induction coil current.

Seat the patient upon a large flat electrode connected with the negative pole. Wrap a protecting mass of absorbent cotton around a carbon hand electrode, moisten it in hot

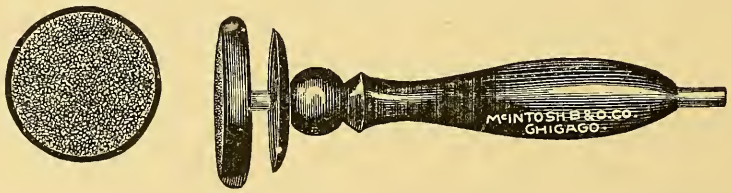


Fig. 436. Carbon disk electrode.

water, connect it with the positive pole and apply it to the enlarged gland. Switch into circuit the rapid vibrator, three or four cells, and combine the entire 32 secondary coil with the 500 yard No. 36. Gradually increase the current strength through the rheostat until it produces a firm but comfortable grasp upon the tissues beneath the positive electrode. Maintain the action for at least half an hour. After treatment renew the usual bandage. Repeat the induction current twice a day for a few days and later p. r. n.

CHAPTER LXV.

STATIC CURRENTS IN DISEASES OF THE SKIN.

The place of static electricity in their treatment. Its value for the relief of symptoms and to promote nutrition. The importance of improving the general health in the treatment of skin diseases. The relief of itching, burning and painful symptoms by static electricity. The class of cases to which it is suited. Falling of the hair from debility or defective nutrition of the scalp. Method of treatment. Effects. Alopecia. Indications for static electricity found in the constitutional state of the patient. Local and general benefits of electrification. Acne. Static electricity useful to promote systemic nutrition. Its influence upon the causes of acne. An efficient auxiliary aid to treatment. Local anæsthesias. Anhidrosis. Carbuncle. A clinical case. Dermatalgia. Static electricity relieves the symptom and treats the cause. Dermatitis. Beneficial action of the sedative breeze in acute inflammations of the skin. Eczema. Symptoms and causes indicate static electricity. Principles of successful treatment of eczema with static electricity. Elephantiasis. Probable relief of symptoms by static sparks. Epithelioma. Temporary relief of pain by the static breeze. Erysipelas.

STATIC electricity is not a panacea for cutaneous affections and probably the dermatologist would be one of the last men in medicine to consider a static machine as part of his office equipment.

But for the general practitioner who is called upon to treat a great many of the simpler and more curable cases it is worth while to consider how he may employ an apparatus for which he has paid a large sum and which will render him and his patients services of very great value.

Static electricity cannot take the place of cleanliness, the evacuation of pus, surgical measures, mercury, sulphur, carbolic acid, etc., but it is useful for the relief of some symptoms and to promote the general and local health.

One of the most practical recent writers upon dermatology says:

> Every patient should be regarded as out of health in some way quite apart from his skin trouble, and examined as to the performance of all his functions quite as carefully as if he had come to you for the treatment of some internal disorder.

The same writer also says in regard to new remedies, some of which appear nearly every month, that

> careful comparative tests demonstrate that many of them are no better than the old and tried ones. It is better for the general practitioner to learn how to use a few drugs than to try every new thing.
>
> By practical experience he will be surprised to see how much he can accomplish with a very small assortment of drugs. The greatest secret in the treatment of eczema and many other skin diseases is not what particular drug or formula is good for the disease, but a knowledge of the great principle that acute diseases need soothing remedies, and subacute and chronic diseases need stimulation.

If the physician will turn from this statement by a very competent dermatologist and read afresh the chapter of this book which describes the local and general sedative, tonic, stimulating, counter-irritant, and nutritional action of the different forms of static administration, it will appear plain that this agent is a substitute for some part of the routine treatment of skin diseases in a great many cases, and that in some cases it will produce benefits to the patient which cannot be obtained so well in any other way.

For the relief of itching, burning, and painful symptoms it surpasses any palliative known to me, and I have tested a very large number.

If we consider skin diseases without the myriad subdivisions which enter into the description and diagnosis in classical works on this subject, and regard them as either functional or organic, and apply principles of treatment with regard both to the cause and the pathology of the lesion, and still further eliminate the lesions which fill the pages of literature but are

rarely seen in private practice, we get down to a working basis for the application of static electricity.

In the following remarks I have drawn freely from the writings of Dr. George Thomas Jackson, who in turn acknowledges his indebtedness to Crocker, Fox, and other leading workers in the field of modern dermatology.

Falling of the Hair from Debility or Defective Nutrition of the Scalp.—Seat the patient upon the static platform in the usual manner, and if the hair is thin and the current is not irritating, or if the irritation can be satisfactorily removed by interrupting the breeze, apply a strong negative head breeze for about ten minutes every second day.

The platform should be connected with the positive pole, and the grounding chain attached at the same time both to the negative pole and to the breeze electrode.

If there is some soreness of the scalp, or if the hair is thick, or if for any other reason the application must be made milder out of regard for the comfort of the patient, the head breeze must be connected with the positive pole and the platform to the negative.

If the patient's health is below par other tonic applications to the spine and general surface may be applied as indicated.

It is a matter of common observation that patients undergoing a course of treatment with static electricity for some other chronic affection notice that their hair ceases to fall out, and as the general nutrition improves in a couple of months' time the nutrition of the scalp has also been improved.

Clinical Remarks.—Dandruff is said to be the most frequent cause of premature baldness, and dyspepsia is not only one of the most common diseases but is probably also one of the most common explanations of the loss of hair. The nutrition and proper blood supply of the vital organs is the first consideration of nature. When she cannot command a sufficient quantity of circulating nutrition for all parts of the body she retrenches at

the extremities and cuts off the supply first from parts which are the least vital, like the hair and the nails.

The reader who studies the effects of static electricity upon the general circulation and nutrition will note that it is definitely indicated in these cases.

Alopecia.—Some forms of this condition are far beyond the reach of any remedy, and others are amenable to specific medication, but the neuralgic pains of alopecia areata may be relieved by the static breeze, and the fact that the disease has a strong tendency to spontaneous recovery in the course of time would suggest the probability that static applications might aid nature a good deal; especially when the patients are "of a very nervous temperament, exhausted by overwork or nervous strain, or are out of health in some way."

If the neurotic theory of the disease is correct it would be an additional reason for employing electricity. Jackson especially says: "One duty we have without peradventure, and that is, to look after the general condition of the patient. A large number of the cases require a stimulating and tonic treatment —iron, quinine, strychnine, arsenic, cod-liver oil, or hypophosphites. Children should be allowed to run free and taken out of school. Our hardest task will be to manage those nervous patients who are ever a trouble to us." This certainly calls for static electricity with a loud voice.

This is apart from the local treatment, which is summed up in two words, "patience and stimulation"; but the general indications for static electricity could not be more clearly stated than they are stated above by the dermatologist who had no thought of such an agent in his mind.

The nervous patients who are ever a trouble to the dermatologist are particularly amenable to relief by skilful static administrations, which are as welcome to them as shade to the traveller in the desert.

Acne.—In these cases static electricity may be useful to

promote the systemic nutrition of the patient rather than locally to treat the sebaceous glands.

It may be stated as a broad general rule that anything which lowers the general health of the patient contributes to the production of acne. Thus, we have the vague state "general debility," anæmia and chlorosis, oxaluria and uræmia, rheumatism and gout, poor circulation, bad personal hygiene, mental and physical exhaustion, and chronic malaria, cited as causes by writers upon dermatology.

These are all the particular conditions which general static electrification influences favorably, as may be seen by reference to the chapter on its physiology.

Of treatment Jackson says: "In the treatment of acne we can obtain a cure most surely by attention to the general condition of the patient; most rapidly by a combination of internal and local treatment; and we should therefore begin the treatment of a case by careful inquiry into the general condition of the patient, and endeavor to regulate any, even the slightest, derangement of the internal organs."

The thorough treatment of these cases therefore involves the local measures usually employed, the regulation of diet and hygiene, and the application of the principles of general medicine to the relief of constitutional disorders.

Static electricity will be found an efficient aid to the constitutional part of the treatment.

Anæsthesia.—This is a loss of sensation in the skin which occurs in a number of diseases of the nervous system, notably in hysterical affections. It may be general or partial, and is probably more successfully treated by static stimulation of the sensory nerves with either short friction sparks or long sparks than by any other means.

Anhidrosis.—This symptom may be local or general, and depend upon a number of causes, but when it is neurotic the restoration of the function of the sweat glands is directly in line with the physiological actions of static electricity.

The usual treatment recommended is "tonic exercise and bathing," and it is evident that the capabilities of static electricity far surpass either of these measures. It can be added to them with good effect.

Carbuncle.—Apart from surgical measures Jackson says "As the disease is an exhausting one, the patient's strength is to be supported from the start, and his nutrition kept up by a generous diet. Fresh air by good ventilation must be secured. If the pain is excessive, opium or morphine is indicated especally to secure sleep. Iron is a valuable remedy all the way through, and quinine or antipyrin if the fever is marked. Alcohol should be given if suppuration is free, especially if there are any signs of exhaustion."

The author has had no experience in the treatment of carbuncle by static electricity as a supplementary measure, but the following case was reported by Harper in April, 1893:

On November 10th last a gentleman called at my office suffering greatly from effects of a carbuncle at least three inches in diameter and thoroughly honeycombed, on the side of his neck. During several nights he had not been able to sleep.

I at once made a crucial incision to the full extent and depth of the morbid mass, and then applied a static breeze which favored the free flow of pus and relieved all pain.

The following day the patient asserted that he had slept all night, had a good appetite, and had not suffered a twinge of pain since he left my office.

On the fourth day, with the aid of small forceps, I drew out all morbid material, which was of so firm a character that some pieces were one and one-half inches long and it was necessary to cut them loose from the bottom.

On the following day it occurred to me that I might bring about adhesion of the four flaps instead of allowing them to slough away. Accordingly, I strapped them down tight and drew sparks from the surface.

On the next day half their extent was adherent, and in twenty-four hours more full adhesion had taken place, leaving only a scar as from an ordinary incision.

The patient never lost a meal from the time of his first treat-

ment, could lie sleeping on the affected side, and had no recurrence of any pain whatever. Having heretofore seen severe and prolonged suffering from carbuncles, I desire to report the results in the above case.

Dermatalgia.—This neurosis may disappear of itself "after weeks or months." The pain is variously described by patients as boring, pricking, or burning; or numbness or coldness may be complained of. It may be constant or intermittent in character and is sometimes so severe as to be agonizing. The symptomatic form occurs in locomotor ataxia, rheumatism, syphilis, malaria, diabetes, hysteria, chlorosis, and about the menopause.

Treatment: "If we can remove the underlying cause we can cure the trouble, so our remedies should be first addressed to it. Unfortunately, for some of the diseases of which dermatalgia is a symptom we can do little. In any case, the patient demands some local treatment to relieve the pain."

Of the score of remedies suggested by the writer of the above paragraph every one of them is distinctly inferior to the best and simplest remedy which he does not name.

The capabilities of relief by static applications varying from the positive or negative breeze to the spray and spark, according to the situation and extent of the dermatalgia, not only include the immediate cessation of pain at the first sitting, which lasts for a longer and longer time as the sittings are repeated until in many cases it becomes reasonably permanent, or in incurable cases is reasonably palliated, but far beyond the affected area of the skin the reflex and constitutional benefits of static electrification exercise a beneficial influence upon almost every one of the important diseases of which the pain is symptomatic.

Whatever special medications may be indicated by the presence of rheumatism, syphilis, malaria, diabetes, and chlorosis, it is certain that static electricity will increase the benefit they produce upon the general system, and it is the most effectual

local remedy that can be applied to the site of pain. Daily and long sittings are advisable if the case is stubborn, and more dependence should be placed on the negative breeze than on sparks.

Dermatitis.—While nearly every case of dermatitis will naturally be treated by ordinary methods, yet it has occurred in my own experience that on the first visit of the patient to the office and before applying any local dressing, it has been worth while to treat the part with a sedative static breeze.

By this means the relief of pain is instantaneous while the breeze is passing, swelling is reduced, the intensity of the inflammation is lessened, and severer symptoms are cut short. In fact the comfort of patients has been so agreeably promoted that they have expressed very lively appreciation.

One advantage in addition is the abatement of constitutional disturbances through the sedative and restorative action of the general electrification upon which the breeze is engrafted. In later stages when itching is a marked feature the breeze also relieves this. It must be applied upon the bare skin.

In the many forms of chronic dermatitis the static breeze will be found an excellent palliative to the symptoms and an effective means of applying local sedation or stimulation, whichever may be needed.

Eczema.—It has been said that the physician who learns to recognize and treat syphilis and eczema has in his possession the key to the whole of dermatology.

There are six prominent symptoms of this inflammatory and frequent skin disease: redness, itching, infiltration, tendency to moisture, crusting or scaling, and cracking of the skin. The subjective symptoms are itching, burning, and a feeling of heat and tension.

About twenty-five varieties of eczema are described. Some of them last a few years and some of them last forever, with occasional vacations.

Of the predisposing causes the most universal and active is

some disturbance of digestion, constipation, malassimilation, perverted nutrition, derangement of the liver. At other times the kidneys are at fault. Diabetes and Bright's disease both predispose to eczema. Chlorosis and anæmia, uterine disorders and the menopause, and the strumous diathesis are at times active factors. Derangements of the nervous system are exciting causes; now and again we will meet with cases which appear suddenly after some nervous shock. Rheumatism and gout and varicose veins are other predisposing causes.

To most of these internal causes some external cause must be added before the eczema appears, and the external irritants are about the same things which will cause a dermatitis, "only the action goes further and a catarrhal condition results."

As this is the dermatosis which the practitioner is most often called upon to treat, and as chronic cases are exceedingly stubborn and return again and again after temporary "cures," and the remedies are countless, it is well to have in mind a condensed synopsis of the chief principles of treatment.

Regarding the patient as a sick man it is obvious that constitutional measures which will improve the powers of nutrition, correct disease, and regulate functions are indicated.

Whatever else may be prescribed for the general condition, there is no internal prescription which will "cure eczema," but there are two measures supplementary to diet, hygiene, and indicated medication which are of very great value. These measures are the most nearly curative of any known to the writer, and the *rationale* of their action can better be appreciated by first reading a description of the causes of eczema and then reading the physiological effects of the galvanic and static currents.

I believe central galvanization to be the nearest approach to the best single constitutional remedy that can be employed, but the nutritional properties of general static electrification are also of considerable value.

It is, however, as a local relief to the itching and other

symptoms and as a means of applying local sedation or stimulation, whichever may be needed, that static electricity possesses a very great value as an auxiliary to central galvanization.

The principles of local treatment laid down by writers are: "In acute cases employ soothing remedies; in subacute cases use astringent and slightly stimulating remedies; in chronic cases stimulate; in all cases protect the skin from external irritation."

The use of water is generally advised only in chronic cases, and in such cases I have obtained the best results by making the galvanic application within an electro-thermal bath cabinet, after which I have made the static administrations at the same sitting.

It should also be noted that while there are numerous conditions presented by patients with chronic eczema which seem to call for special medication, yet it has been my fortune to have patients give a history of long medical treatment with no practical benefit, and when I have treated them with galvanic and static currents and simple external measures for protection from irritation they have become quite comfortable in a short time and have progressed to an improvement directly in proportion to their perseverance in treatment.

Some have simply got better and stopped treatment, and some have continued longer and got more nearly well. In an ordinary case twenty treatments will produce results that would require a course of thirty or forty applications in a more obstinate or complicated condition.

In very simple and recent cases which present only a catarrhal condition, the local application of a spray mingled with fine sparks from the brass point electrode is often entirely adequate.

Elephantiasis.—This chronic disease is characterized by hyperplasia of the skin and subcutaneous tissues, due to a stoppage of the lymphatics, affecting chiefly the lower extremities, and marked by enormous enlargement of the affected part.

While the writer has of course had no opportunity actually to test the effects of static electricity upon this condition, yet it must occur to all who are familiar with the effects of static sparks that they would relieve the sense of weight, pressure, pain, and other symptoms with which the patient might be affected.

It is by no means necessary to estimate the remote possibilities of a cure in order to consider static electricity as likely to give relief to some part of the trouble and greatly promote the comfort of the patient.

Epithelioma.—The only possible utility of static electricity in cases of epithelioma might be the relief of the sharp pain which is sometimes present by the positive spray, either before or after operative measures.

Erysipelas.—If the patient is first seen at an office visit the subjective symptoms of burning, tingling, itching, tension, and pain may be greatly relieved in ten minutes by the application of a positive static spray and the patient may then be sent home with a greater degree of comfort than could be obtained by any other means. After appropriate treatment the period of convalescence may be shortened and renewed strength very quickly established by a few office visits for further tonic administrations of positive electrification and spray to the spine.

CHAPTER LXVI.

STATIC CURRENTS IN DISEASES OF THE SKIN (*Continued*).

Boils and persistent furunculosis. Curative effects of static treatment. Herpes and herpes zoster. Value of static sedation in acute stage. Relief of burning, itching and neuralgia. Value of static electricity in chronic and debilitated cases. Hyperæsthesia. A clinical case treated with static electricity. Hyperidrosis of the feet. Leucoderma. Negative results of treatment. Lupus. Indications for the general nutritional effects of static electricity after surgical measures. Pruritus. Static electricity the most successful remedy. Report of cases. Method of treatment. Psoriasis. Static electricity to improve the nutrition of the patient. Scrofuloderma. Indications for static electricity as an adjunct to medical treatment. Dandruff best treated by the static head-breeze. Varicose ulcers. Improvements of local nutrition by static sparks. Tenderness of the scalp. Chronic urticaria. Relief of itching and constitutional improvement. Remarks upon the general usefulness and limitations of static electricity in the treatment of cutaneous affections.

Boils.—In the case of the ordinary single acute boil for which local treatment is efficient, the only application of static electricity would be the sedation of pain by the positive breeze if circumstances made it convenient to employ it. The spark would also promote resolution if there was some induration after the discharge of pus.

My experience refers more particularly to the repeated crops of small boils which constitute the condition known as furunculosis.

Seat the patient upon the static platform connected with the negative pole of the apparatus, ground the positive pole and the brass ball electrode. With the machine in slow action apply a few single thick but mild sparks upon each individual lesion.

If it is a blind boil with no tendency to suppuration the

mass will be dispersed in a few days and may not need more than a single application. In such of the other *foci* as show a more acute inflammation the process of suppuration will be hastened.

These crops of boils are the kind which persist for months or even years if left untreated, and are often very obstinate under any kind of medical treatment. It is suggested that diabetes mellitus may sometimes be the cause, and of course if this disease exists it should receive attention. One of the best aids to diet and the usual treatment of diabetes is static electricity, but mild static sparks will dispose of these crops of boils in short order and without much apparent regard to the particular cause.

If the patient's general health is below par it would be advisable to continue nutritional static treatment for several weeks if it was needed, but the local symptom of deranged health will disappear promptly under the local sparks.

Herpes and Herpes Zoster.—The varieties of herpetic inflammations of the skin are marked by burning, stinging, or itching in the part and in the case of shingles by neuralgic pain in the nerve along whose course the eruption is about to appear.

The value of static electricity in these cases is found in the very great relief which the positive breeze and mild spark afford to the symptomatic disturbances.

In a severe case of herpes zoster the sedative application would need to be repeated daily during the period of greatest pain. I have seen patients express great satisfaction with the comfort afforded by static electricity, but do not know that it has any direct effect upon the course of the lesion in recent and favorable cases. It certainly, however, is a great benefit in old and debilitated cases and when recovery is not progressing as it should.

Hyperæsthesia.—The following case of chronic cutaneous

hyperæsthesia was reported by the author in the *Medical Record* for November 18th, 1893:

W. J——, male, aged 62. The disordered sensation was limited to the trunk of the body, his upper and lower extremities being entirely free. It had annoyed him persistently for thirty years, and during the past eight or ten years it had forced him to undress and retire to bed about 4 P.M. daily, as the weight and contact of his clothes, which could be worn comfortably on rising, became by that time unendurable. In other respects he was usually able to attend to business, although he was anæmic, dyspeptic, and subject to occasional paroxysms of sciatica of a very severe type. Firm pressure was fully tolerated upon any part of the body, but slight contact or a current of cold air caused an extreme aggravation.

This condition pursued the even tenor of its way undisturbed by season, climate, diet, constitutional state, outward applications, or internal remedies. I devoted more than a year to attempts to relieve him by drugs, but with no better fortune than my numerous medical predecessors from whom I had inherited the case.

He finally decided to accept electro-therapeutics and static electricity was then employed. Its effect was grateful. He was given general positive electrification for ten minutes, followed by a spray from the brass point electrode to every part of the surface of the trunk, followed by a thorough nutritional application of mild sparks to the spine and extremities.

In a week he was remaining dressed until seven or eight o'clock in the evening. In two weeks the relief was such that he was no longer compelled to retire before the usual hour.

He continued this treatment for a month and a half, during which he received twelve treatments at my office and then left the city for the summer. I was afterward informed that his improvement continued and that he had a satisfactory degree of comfort, but considered that he should have received more than double the amount of treatment before desisting.

Hyperidrosis of the Feet.—When this symptom is reported by patients who are undergoing a course of static treatment I am in the habit of applying mild sparks to the feet, and as a rule these patients also have sparks to the spine and nerve centres. No special effect upon the sweating is usually noticed. If there is any improvement at all it is slow and gradual.

Jackson says that local treatment in many of these cases is as unsatisfactory as the constitutional treatment. Some of the local measures employed are undoubtedly detrimental to the health of the patient, but static electricity can do no possible harm even if it fails to yield any brilliant results. There is a remedy called silica which has cured more of these cases for me than anything else I have ever tried.

Leucoderma.—This consists in a disappearance of the pigment of the skin in circumscribed round or oval patches so that white areas are formed. It is probably a disturbance of nutrition. I am unable to discover that dermatology offers anything in the way of treatment. During the past winter I treated a case experimentally about three times a week for two months with negative results.

The application was negative electrification with needle sparks from the brass point electrode over the patches. The patient had experienced a partial sunstroke prior to the appearance of the spots, which had begun to be noticed about four years ago. At the time of coming to me her health was in a generally depraved state and she was not a very hopeful subject.

Lupus.—"As lupus is a tuberculous disease and sometimes is followed by tuberculosis of the lungs, care must be given to the general health of the patient and he must be placed in the best possible hygienic surroundings. His diet should be nutritious, and cod-liver oil, iron, and iodine should be given. But external treatment is of the greatest importance and the disease must be gotten rid of root and branch."

The indications for the general tonic nutritional effects of static electricity after the surgical treatment of lupus are sufficiently set forth in the above extract. Static will do good service here.

Pruritus.—Itching of the skin is a symptom common to a great variety of cutaneous affections and it is more or less permanently relieved by the positive or negative spray applied directly upon the uncovered skin. When the functional neu-

rosis called pruritus is encountered by the owner of the static machine, he can relieve it in about the same way.

No one with any medical experience requires any information about the ability of pruritus to render the patient's life unendurable and tempt him to suicide. It is one of the most accursed affections that can afflict a man who to all appearances is entirely well and able to attend to business.

There are two important facts about pruritus occurring as an idiopathic affection. One is that every remedy, either local or general, recommended in every text-book on dermatology, is liable to disappoint the patient and afford him either only temporary relief or none. The second fact is that static electricity will palliate the condition almost as certainly as lotions and ointments will not. The victim of this neurosis may start out with the hope of obtaining a cure, but he will in time learn to be exceedingly grateful for even a palliative that will make his burden endurable.

Leloir (1894) reports as follows:

> During the last two years I have employed the static current with the most unexpected results in about twenty-five cases of localized or general pruritus, the more tenacious of which had resisted all treatment. A good number of cases of the extremities, vulva, and anus were cured after a variable number of applications. The eczematous or lichenoid condition secondary to the pruritus disappeared.
>
> In a certain number of cases the pruritus was relieved considerably but did not entirely disappear. In some cases the pruritus resisted all treatment.
>
> I have obtained analogous results in the treatment of generalized pruritus, but the results have not been so good as in localized cases. This method is of great service in rebellious cases of cutaneous pruritus.

My own experience in the treatment of this affection began with a case of inveterate pruritus of the scrotum in the summer of 1893. Whatever may be the part affected, the principle of the static application is the same.

Seat the patient upon the platform connected with the nega-

tive pole of the machine, ground the positive pole and the brass point electrode. The part must be exposed to the skin for treatment and the best effects will not be obtained if the spray is applied through the clothing.

Start the machine into moderate action and sweep the point near enough to the part to produce a luminous discharge of the spray. Gradually intersperse with the spray a few sparks and repeat them at momentary intervals. The spark must be applied with sufficient vigor to set up considerable irritation and reflex action, and for the moment may intensely aggravate the itching. After about three minutes devoted to this part of the treatment proceed to secure the utmost sedation possible by the application of the positive spray without any disruptive discharges. Persist in the soothing spray for about ten minutes.

Treatment may be repeated with reference to the urgency of the case. After some improvement is effected three times a week until benefit ceases will be sufficient, and if temporary aggravations recur in the future the same method will again be satisfactory.

In very annoying and obstinate cases of pruritus of the anal mucous membrane the static application cannot be so well applied, nor with such marked relief as in more convenient situations, and these may be treated by light applications of cupric electrolysis or the cautery, or any other method that will do any good.

Psoriasis.—The usefulness of static electricity in this disease of the skin will depend upon the state of the patient. If he or she is rheumatic or gouty or neurasthenic, or has pains and pruritic symptoms, or presents any lowered condition of general health, the indications for agents which improve the nutrition are about the same as if the psoriasis was absent. It must be applied according to the local and general indications of the individual patient.

Scrofuloderma.—Patients with these lesions are mostly young subjects, flabby of flesh, with pasty or doughy complex-

ions, a marked tendency to chronic catarrhal inflammations of all the mucous membranes, chains of enlarged glands in the neck, and perhaps some old or present bone lesions.

They are often dull and apathetic and certainly stand in need of vigorous static nutritional stimulation. The ulcers may be treated upon ordinary surgical principles. The regulation of the diet and hygiene of the patient and the administration of cod-liver oil, iron, the hypophosphites, or other tonics is the most essential part of the medicinal treatment.

Those who study the nutritional effects of static electricity will desire to add this agent to the above and will feel that full justice is hardly done the patient who is not afforded the benefits of static electricity in addition to cod-liver oil and the hypophosphites.

Dandruff.—Seat the patient upon the static platform and conduct the treatment upon exactly the same lines described for premature loss of hair. The hygiene of the scalp should be of course sensible and simple. The scalp and hair do not need to be washed any oftener than once a week, and those who feel no irritation during longer intervals find once in two or three weeks often enough. Simple tar soap is good. The habits of using ammonia and borax, pomades, hair washes, hair tonics, and of sousing the hair daily are injurious.

For the treatment both of alopecia and of dandruff, general tonic measures, outdoor exercise, and hygiene directed to keeping the patient in the best possible condition so that the nourishment circulating in the blood will reach the extremities, are nearly always indicated even though the patient may think he is perfectly well. The nutritional results sought for are obtained most readily by general and local static electrification.

Varicose Ulcers.—In the treatment of these conditions sedation of pain and other distressing symptoms may be effected by the positive breeze and mild sparks, and local nutrition and circulation may be greatly improved by sparks which may be administered through the dressing. After the ulcer has healed

the tonicity of the vascular walls and muscular tissues may be immensely improved by the tonic action of static sparks, and the recurrence of ulceration in the future may thus be prevented.

Tenderness of the Scalp.—Seat the patient upon the static platform connected with the negative pole. Ground the positive pole of the machine and connect it also with the head breeze electrode arranged about a foot above the vertex. Regulate the current strength according to the comfort of the patient, which will depend upon the thickness of the hair rather than the degree of tenderness.

Continue the application until complete relief is afforded, whether this requires ten or more minutes.

In ordinary cases, and especially when associated with cerebral neurasthenia or temporary congestion of the local circulation, this treatment is speedily curative. It may be repeated as often as the needs of the patient require. Probably no other form of treatment is so satisfactory. To every such case the sedative breeze is a boon.

Chronic Urticaria.—The vast majority of cases of urticaria recover in a few hours or a few days. In chronic cases it is well, says Jackson, to put the patient on a strictly milk diet for a few days and then add other articles with care.

If the gouty or rheumatic diathesis is at the foundation of the trouble it must be combated. If the outbreak shows marked periodicity sulphate of quinine may do good. Salicylate of soda sometimes does good service even when there is no evident rheumatic tendency. In fact, we must endeavor in every way to get our patient into a normal state of health.

The most difficult of cases are those in which a neurosis alone seems to be the cause. Then belladonna, atropine, arsenic, the bromides, antipyrin, phenacetin, galvanism, pilocarpine, wine of antimony, colchicum, and ergot are recommended. In very obstinate cases the patient should be sent away from home and relieved from all business cares.

Amidst the multiplicity of the above recommendations two

facts stand out prominently: one is that the road to recovery is in the direction of improving the general health, and the other is that medical remedies are disappointing. Some local treatment is of great service in allaying the itching but it will not cure the disease.

Both the local and the general treatment of these cases may be successfully carried out by the employment of the most simple ordinary measures supplemented by static electricity, and the patient will neither require to be sent away from home nor resign himself to the unhappy fate of testing in turn a dozen drugs without relief of a permanent and satisfactory quality.

The positive static breeze applied directly upon the skin with the electrode at as a close range as will avoid a spark will prove sedative to the local irritability and stop the itching.

General positive electrification with a tonic breeze to the several nerve centres of the head and spine will do much to aid the endeavor to get the patient into a normal state of health, and in the treatment of neurotic cases, which the dermatologist finds the most difficult, the static machine achieves its happiest results.

It is also worthy of comment that most of the diatheses which may lie at the foundation of the skin lesion are among the diseases efficiently treated by static electricity.

Remarks on the Limitations of Static Actions.—In the examination of writings upon dermatology we find scattered in many places throughout the pages something very like the following: "Arsenic, nerve tonics, and attention to the general health as well as to the hygiene, both of the body and mind, are our most reliable agents.'

It is quite evident that whenever cutaneous affections are not self-limited and do not tend to spontaneous recovery, and are either caused by, or aggravate, a state of perverted nutrition, some constitutional measures to restore the normal functions are very important.

To estimate rightly the possibilities of help from static elec-

tricity in these conditions the reader should carefully study the well-known physiological actions of the different forms of administering static currents.

It will be seen that none of the electrolytic action of negative and positive galvanic currents is obtained with static applications. Static electricity does not attack pathological tissues, destroy new growths, remove superfluous hairs, set up an active osmosis, coagulate and dry up the blood supply of a vascular nævus, or soften, liquefy, and absorb an indurated mass or fibroid tumor.

On the contrary, the local action of static electricity is for the most part limited to the relief of symptoms, while its general action is directed to the treatment of the state of the patient. Nevertheless, it possesses exceedingly great value in dermatology, and the more it is employed the more it commands appreciation.

CHAPTER LXVII.

ACUTE GLANDULAR INFLAMMATION.

Faradic sedation in inflammation of the parotid gland. Faradic sedation in cases of carbuncle.

NERVE and muscle stimulation and gross muscular contractions are so generally associated in the medical mind with faradic electricity (as commonly employed with batteries giving coarse currents only) that the remarkable sedative properties of fine currents possessing greater potential and interrupted with intense rapidity and unvarying smoothness are often lost sight of by physicians who do not possess the improved form of apparatus. So inexpensive and important an instrument should form part of every medical armamentarium.

Those who are most familiar with faradic sedation and who possess the improved coil apparatus employ it chiefly in gynecological practice, but it is of equal value to combat local inflammation upon the surface of the body.

Parotid Gland.—In selecting the following case I do so because of its acknowledged intractibility and widespread destruction of muscular and bony structures. Sloughing of the soft parts is common and necrosis of the bony structures not infrequent. In addition to this the case was indeed a typical one and continued to grow rapidly worse under the means ordinarily used to arrest it.

Miss E. L., age 16, a young lady of exceptional constitutional vigor and fine physique, in the third week of typhoid fever developed a most violent inflammation of the left parotid gland from occlusion of the buccal duct.

The temperature at once mounted to 104 degrees, tongue dry, and pain in the region of the gland became so severe that hypodermics of morphine failed to give comfort, as the gland continued to secrete with no outlet for the accumulating

fluid. The tumefaction and swelling became more and more pronounced until all the structures of that side of the neck as far down as the clavicle became involved. Deglutition became difficult, and only liquid nourishment given with a spoon was possible.

For three days I endeavored without avail to stay the inflammatory process with anodyne embrocations, hop stupes and poultices, together with internal medication including aconite, phenacetine and calomel. The inflamed zone began to show unmistakable evidences of blood stasis in a dusky dark red color accompanied by an unyielding temperature.

I at once apprised the family of the gravity of the case, stated the possibilities of sloughing of the gland and contiguous parts with a possible necrosis of the bony structures, and likewise stated that laying open the gland and following this up with antiseptic irrigation and antiseptic dressings would give the desired relief, but the young lady would be left with an unsightly scar. She begged me, if possible, to avert this.

My past experience with faradic sedation in inflammatory lesions encouraged me to offer the family a hope that with it I could arrest the inflammation, preserve the integrity of the gland, limit the destruction of tissue, and avoid the much-dreaded facial blemish if they would patiently and perseveringly co-operate in the treatment.

An electrode well padded with absorbent cotton and large enough to cover well the entire inflamed surface was at once applied and connected with the positive pole. The negative electrode was placed for convenience at the feet. Both were kept constantly wet with a warm saline solution. The current from a Kidder Coil Apparatus was increased from zero until it was just perceptible to the patient, and applications were ordered to be maintained for one hour in every four. All other local treatment was suspended.

After the first twenty-four hours the tension of the parts was lowered, the capillary circulation was improved by forcing the blood to other channels, the integrity and tonicity of the blood channels in the inflamed area was slowly restored, and extra-vascular pressure proportionately reduced.

With the reduction of tension and extra-vascular pressure and the arrest of transudation the nerve filaments were gradually relieved of pressure and pain was correspondingly lessened.

The temperature record showed a slow but gradual decline from day to day, no more antipyretics being used, but did not reach the normal point until the tenth or twelfth day. No opiates or anodynes were given meanwhile, the patient being

encouraged to bear a moderate amount of discomfort rather than incur the risk of depressing the system with drugs. After the tenth or twelfth day the fever and pain subsided, the tongue became moist, the appetite improved, and my patient was comfortable and remained so to the end.

Having now arrested the inflammatory process after a stubborn fight I set to work to remove the inflammatory products. In this connection I feel constrained to emphasize the great superiority of faradic electricity in these types of acute local inflammation over the therapeutic agents ordinarily used, because in it we possess a remedial agent that not only favorably modifies, limits and shortens the inflammatory process, but in the same physiological manner hastens resolution, removes the inflammatory products and promotes repair.

That the proper induction coil current accurately regulated in dosage will do both has been demonstrated absolutely in my own personal experience and is in direct conformity with the well-known physiological actions of high-tension currents rapidly and evenly interrupted. This dual action of this electrical remedy is without a parallel in drug therapeutics, and will, when better known to physicians, give it a prominence and range of application supremely above the host of agents that have from time immemorial been applied to extinguish inflammatory trouble. Indeed, I assert without fear of successful contradiction that there is not a single other agent in the entire therapeutic list with physiological effects so clearly adapted to arrest inflammatory processes as is faradic electricity.

My recent preceptor in gynecology, Professor R—— (and should he chance to read his name in connection with electricity I, in advance, ask his pardon because of his inveterate hatred for electricity), with all the emphasis a man of his fixed conditions could enunciate, repeatedly stated to the class of physicians of this year that in all conditions of blood stasis the sheet-anchor, the great weapon of defence, the power behind the throne, was the weapon that kept the blood current in motion. The blood must not linger nor tarry in the blood channels, but must be induced to move on, and he referred to the benign effects of poultices in pneumonia and of hot douches in metritis by way of illustration. In pneumonia to induce the blood to flow on and to contract pulmonary vessels; in metritis to induce stagnant blood to flow more rapidly, and secondarily to permanently contract vessels.

That great pathologist, Senn, has truthfully declared, in terms not to be misunderstood, that the "great desideratum never to be lost sight of in inflammation is to preserve intact

the blood channels; that whatever impairs the *vis a tergo* of the circulation proportionately augments the inflammatory process; that the coal-tar products so popular at present are hurtful antipyretics in inflammatory fever because a reduction of temperature is secured by directly lessening the heart's action."

Congestion not only precedes but predisposes to inflammation by lessening the resistance of the tissues. For local infection there may be at least three factors, viz., microbes having active pyogenic power, a medium favorable for their development, and a loss of tissue resistance. To these may be added the condition of the local circulation and vitiated or perverted secretions.

A proper conception of these factors demonstrates unquestionably that in congestion as well as inflammation the only scientific, rational method of arresting either process is to keep open the blood channels and prevent the aggregation of the leucocytes and the stagnation in the blood stream. Whatever will do this will proportionately lessen exudation, transudation and extra-vascular pressure; prevent tension and limit pain. Not only so, but whatever modifies or lessens these inflammatory factors must necessarily limit the inflammatory products, and we have fewer to remove after the arrest of the inflammation.

Faradic electricity through its mechanical action is the only agent that meets all these indications.

Its benign effect upon the circulation keeps within contact with the affected area the more highly vitalized blood. This reinforces the adjacent tissues and increases their power of resistance. Distention of the capillary vessels with subsequent rupture of their walls is in a large degree prevented, and inasmuch as the leucocytes are recognized as carriers of infection and are found in the products of transudation and exudation that always pour out through these breaches of continuity the importance of preventing rupture of these vessels cannot be overestimated. Over-distention is prevented and corrected by constricting the arterioles and stimulating a healthy collateral circulation.

After the arrest of the inflammation in the above case there was still considerable swelling and engorgement, and the applications were continued for fifteen days longer to remove the inflammatory products, with perfect restitution at the end of that time.

The latter part of the treatment was made with a more stimulating induction current and the sittings were shortened to 30 minutes and only two or three times a day. After the

first part of the second stage of treatment the application of a high-tension coil current for fifteen minutes once a day is sufficient.

The recovery was perfect. There has been no recurrence, and the young lady is here to testify to the truthfulness of my statements. While I visited the case thrice daily for the first ten or twelve days and every second day during the last fifteen, the applications were made by the young lady herself, and on many occasions the effect was so soothing she continued the *séance* two, three, and four hours. (*Williams.*)

Carbuncle.—Six cases of carbuncle have been treated by me by faradic sedation. The result was all that could be desired in every case.

Mrs. W., age forty-five years, of nervous temperament and moderately vigorous, had been suffering from a carbuncle on the hip for a week when I was called to see the case. The denuded carbuncular area measured between three and four inches in diameter and presented a dry desiccated surface. There was a temperature of one or two degrees and the severe pain required the free use of opiates.

She had received domestic treatment with flaxseed poultices, etc. Her apology for not calling in professional aid sooner was a "dread of the knife," and she only consented to summon the writer when assured that it would not be used.

I at once began faradic sedation by applying an electrode well padded with absorbent cotton and large enough to cover the inflamed area. This electrode was connected with the positive pole of an improved Kidder Coil Battery. A larger electrode, 4 × 8 inches, was connected with the negative pole and applied under the buttocks. The current was gradually increased until it was just strong enough to produce a susceptible and not unpleasant sensation. The electrodes were repeatedly wet with a hot-water solution of salt and the applications were made one hour in every four.

In the case of Mrs. W. no anodynes were required or given after the first twenty-four hours. After the fourth day the desiccated area of the carbuncle was permeated with moist secretions from beneath, and with my rat-tooth forceps I was enabled without pain to remove the dead tissue now detached and thrown off by the healthy granulation underneath.

The applications were continued as before for three days longer when the case was dismissed, only using for a few days a five per cent. solution of carbolized oil which had been kept on the surface all along in the interval between treatments.

What special advantages had this treatment over the ordinary surgical methods?

In the first place it is less painful and the patient has no dread of it.

In the second place, if applied in the incipient stage before there is a formation of pus, a certain per cent. of cases can be aborted, or if not aborted certainly the inflammatory process can be very much circumscribed, which is a very material consideration.

In the third place resolution is consummated with far less constitutional disturbance.

In the fourth place the treatment is far less formidable to the patient than the bistoury or even the hypodermic syringe.

In the fifth place the induration is dissipated very much sooner.

How are these effects accomplished by this remedy?

The answer is first, that the rapidly interrupted sedative-tonic induction coil current (not a common faradic-battery current) acting through the vaso-motor nerves constricts the arterioles, limits dilatation, and by urging the blood forward in the blood channel prevents stagnation, deoxidation and certain death to all that portion of the inflamed zone which is deprived of life sustaining, highly vitalizing blood.

Second. By its benign effects on the capillary circulation the blood is diverted from the inflamed zone to other channels whose integrity has not been impaired by the inflammatory process and the engorgement is proportionately lessened.

Third. By keeping the blood channels open, transudation into the extra-vascular spaces and tissues is limited. The removal of this compression and obstruction to the circulation is an important factor.

Fourth. As the pain is largely due to exudates which compress the nerve filaments, the action of the current which limits and removes exudation relieves the pain in the same degree.

Fifth. By keeping open the blood channels the scavengers and microbe destroyers of the system are constantly transported to the site of inflammatory warfare to perform their wholesome work and limit infection.

Lastly, omitting much that might be said in favor of the rapidly interrupted current in the class of cases under discussion, its mission does not stop with an arrest of the inflammatory process as does surgery, but without a parallel in therapeutics by the same identical physiological actions exercised to arrest the inflammation it hastens resolution, promotes absorption of the inflammatory products and favors early restitution. The second proposition is no less true than the first. (*Williams.*)

CHAPTER LXVIII.

MISCELLANEOUS CONDITIONS.

An electric bath for children. Faradism in infantile marasmus. Static electricity in infancy and childhood. The congestive chill stage of intermittent fever. Catalepsy. Cold extremities. Habitual subnormal temperature. To abort an incipient cold. Acute fluent coryza. Sprains and contusions. Hypostatic congestion and local œdema. Ascites. Exudations and infiltrations. Chronic varicose conditions of the lower extremities. Phlebitis. Obesity. Hiccough. Morphine habit. Chronic alcoholism. To eliminate metallic poisons by an electrolytic bath. To produce local anæsthesia by cataphoresis. Relief of toothache. Painless dentistry. Sore and bruised gums following dental work.

An Electric Bath for Children.—In marasmus and other forms of debility, in infants and young children, the general tonic effect of electric currents (preferably the faradic) may be employed with advantage in a very simple manner. It is easy to improvise a useful electric bath. Put the infant in any wooden tub of plain warm water, suspend any flat electrode connected with the positive pole at the head of the tub a few inches away from the child's back but without touching it. Adjust a similar negative electrode near the feet. Support the child for about ten minutes in the tub with a rapidly interrupted No. 32 secondary coil current adjusted to the comfort of the child, which can readily be determined by observing its actions. Repeat twice a day, as children require frequent *séances* on account of their rapid tissue change. The method is one which should be given at home under the direction of the physician. It is simply an admirable nutritional tonic.

Faradism in Infantile Marasmus.—If the experience of the reader has been similar to that of the writer he will readily join in the assertion that infantile marasmus is a very stubborn

condition to influence with drugs. An emaciated infant which has become wan and haggard through imperfect assimilation of food or the prostrating effects of cholera infantum or other depleting disease, and in which digestion is impaired and nervous system disturbed, in which there is almost constantly hectic fever present, with exhaustive alvine evacuations in many cases, passes in time the boundary line where drugs are capable of exerting a beneficial influence.

Such cases slowly waste away and die if the destruction of tissue be not met by proper nutrition, and how to bring about the condition in which this may become possible is a serious problem.

We have within the last five years been surprised at the results of general faradization in a number of cases, where, judging from former experience with drugs, a fatal issue has seemed inevitable. And it has not been necessary to draw upon the imagination through many weeks of treatment to arrive at the conclusion that electricity was the successful agent. The effects have been prompt and marked, quite evident after three or four applications at intervals of every second day.

To apply in these cases place the positive pole at the feet and the negative pole at the nape of the neck, regulating the current to a mild dosage, and allow the poles to remain three or four minutes. Then place the positive pole at one foot and hold the negative at the opposite hand for some length of time ; then place the positive at the opposite foot and hand as long.

A child that has not rested for weeks will, in a few nights after the beginning of this plan, rest quietly all night and begin to gain strength and flesh.

What we prefer to the plan of application above mentioned is the electric bath, when the child will submit to immersion in water.

The faradic bath may be administered to an infant in an ordinary wooden laundry tub. In any event the tub should be wood or some non-conductor, not metal. Fill the tub two-thirds full of water at a temperature of ninety-eight degrees, place the child in the water and place the positive conductor into the water at a point opposite the feet while the negative is held in the water back of the head or neck. (*Webster.*)

Static Electricity in Infancy and Childhood.—The diseases of children which do not belong to the epidemic affections or to the acute inflammations are for the most part of a functional nature. In the latter class of cases children are susceptible to

improvement by the action of remedies which regulate the functions and improve nutrition.

It is not my intention to suggest any substitute for ordinary medical procedures, but there are times when the mother is very anxious, and the physician would not intentionally deprive her of any remedy which would help her child. In marasmus and conditions of extreme prostration, hyperexcitability or dangerous apathy of the nerve forces, the static machine may be a boon in thousands of cases. The tonic effect of seashore air to children who are prostrated with summer heat in the city is not more pronounced and decisive than the benefits of positive static electrification.

A child of any age above a couple of weeks old can be safely held upon the static platform in the arms of either a nurse or the mother and subjected to general electrification without alarm or conscious sensation of any kind, and without undressing. The mother's feet should rest upon the metallic foot-plate connected with the positive pole and one hand should hold the bare hand of the baby, so as to make direct connection without intervening resistance. If the child is held around the body and outside the clothes the current will pass through to the infant in the form of a small spark, and probably result in tears.

H. B——, aged 7 weeks, bowels loose, has been very ill; bottle-fed baby; has had acute diarrhœa for three days; will not sleep, cries all the time, and the mother is greatly alarmed. Medication has failed to establish an improvement.

September 11th, 1896. The mother held the child upon the static platform and both received ten minutes of positive insulation. On the 14th she came back reporting that the child had slept three hours immediately on returning home, and had since been quieter and the diarrhœa had ceased. On the 16th the child was seen to be improving rapidly with no other treatment than static electrification, of which three treatments had now been administered. The external application of cod-liver oil was begun, with an internal auxiliary remedy, and under the joint influence of these and two more static applications the child improved considerably.

The baby weighed nine pounds at birth and only ten pounds at eight weeks old. On October 2d he was brought to the

office again and showed signs of intestinal irritation. Both mother and child were given fifteen minutes of positive static electrification and a change was suggested in his diet, since which time he has grown well and hearty. The efficacy of the static administrations in arousing the nutritive processes is certainly useful in all such cases. The mother was also very much run down, and it was as much benefit to her as the child.

Upon the first visit the baby cried continually and was almost uncontrollable at first, but quieted down a good deal under the soothing influence of the current. At subsequent visits he was perfectly quiet and showed the usual appreciation of the static machine.

L. H——, 18 months old, has been sickly for a long time. Her mother has had four previous children and never succeeded in getting any one of them past the age of one year and one-half. The baby was extremely emaciated and the cachectic state was considered due to worms. The mother was frightened and crying from the belief that her child would soon pass away, and both were put upon the static platform connected with the positive pole. This was at the beginning of February. Medication was of course prescribed for the case and the mother instructed to examine the stools. Nothing was discovered to confirm the diagnosis, and the remedies were changed to cod-liver oil externally and a simple aid to digestion. After the first administration of static the child immediately ceased to get worse. She was treated only three times a week during the month of February, 1897, and before the middle of March has now become a comparatively active and hearty child.

When static electricity is administered to infants they often sleep during the entire process, especially after the first sitting. If the current was administered every day for a time it would probably do them much more good, but if it arouses a reaction even when administered at longer intervals, and enables other remedies and home treatment to attain their desired results, it is worth employing.

It appears to me that in desperate cases it would often turn the tide in the child's favor by its undeniable restorative action upon the forces which energize the vital organs and carry on the processes of nutrition.

The Congestive Chill Stage of Intermittent Fever.—For several years after I began practice it was my fortune to be located in a malarial district. I have many cases of this

form of fever, mostly in children. Knowing the action of electricity on congested parts I decided to apply the galvanic current on my next case of pernicious fever. I did so and was so well pleased with it that I employed it in every case I have had since. The death rate on my books is less than before.

If I can see the little sufferer before it is too late for *any* treatment I have little fear that I cannot reduce the congestion in a few minutes, When the congested face comes back to its natural color and the patient can breathe easily the danger is passed for that day, and no one will let it occur two days later if possible to prevent it, and that can be done with almost every case.

Have the nurse strip the child, moisten a felt or sponge covered electrode, about 4×4, in the usual hot-water solution of bicarbonate of soda and connect this with the positive pole of a galvanic battery. Moisten in the same way an ordinary sponge-covered hand electrode and lubricate it with a little soap. Connect it with the negative pole. Apply the positive pole at the back of the neck and promenade the negative electrode up and down the spine. Begin with a current strength of five mil. and increase it to 10 or 15 mil. if the skin is not in an irritable state. In a grown person increase the current to 25 mil.

After about five minutes reduce the current to zero and change the electrodes, making the hand electrode positive, Place the negative electrode upon the lower spine, and with a very mild current (about three or four mil.) promenade the positive electrode slowly over the frontal region for about a minute. Then move it to the neck and pass it up and down each side with the current increased to about 7 mil. Be governed by the effect as to duration of treatment and regulation of the dose.

Soon the dark congested look will begin to give way, the heavy stertorous breathing will become less so, and full breathing take its place. Repeat p. r. n. (*St. Clair.*)

Catalepsy.—It is well known how difficult it is to put a stop to the cataleptic sleep, lasting, as it sometimes does, for weeks and months. This difficulty is increased by the absence of cutaneous sensibility. It recently occurred to me to use the faradic current in these cases, applying it to the left nipple, which is known to be a very sensitive spot. The plan proved a success, as the following observations show:

Miss M., æt. twenty-nine. She has the appearance of health. While being examined she was seized with rapid and rhythmical trembling of the limbs on the left side of the body. No cutaneous anæsthesia. Ovarian pain on both sides. For two years she has had convulsive attacks. One morning she leaned

her head on the back of her chair and went to sleep without making any outcry or commotion. Forty-eight hours afterward, she being still in the cataleptic sleep, I made use of a powerful faradic battery. In spite of the strongest current applied to the skin, there was no sign of sensibility, although the muscular reactions were normal. The application to the right nipple gave the same result, but no sooner was the left nipple touched by the current than the patient showed signs of feeling pain. Then she gave a groan and woke up. The patient had other cataleptic attacks, which were always relieved in the same manner.

Miss P., æt. eighteen. Would have cataleptic attacks during the menses, which gradually became more severe. She was brought to me one morning after having been in a state of catalepsy since five o'clock in the afternoon of the preceding day. The sensibility to a powerful electric current was absent on every part of the body except the left nipple. As soon as the electrode touched this point, however, the patient groaned, sat up and spoke. She has had four or five similar attacks, which have all been readily controlled in the same manner. (*Voisin.*)

Cold Extremities.—If these are part of a general condition undergoing electrical treatment, this symptom usually disappears entirely in the course of improvement. If it is due to hepatic torpor, anæmia or incurable cachexia of any kind, it is not likely that local applications of electricity will produce other than temporary effects, and the main treatment must be directed to the cause.

If, however, the coldness is due to disturbances of the nervous system or circulation, or to simple debility, or to any other constitutional or local cause that electro-therapeutics will remove, the correction of cold extremities requires but a moment's extra attention in the course of the regular sitting.

The general action of positive electrification, and especially when interrupted by the author's method, tends to equalize the body warmth, but in cases in which natural reaction is not taking place during other treatment a few mild sparks should be applied to the soles of the feet through the shoes, and also to the lower part of the forearms.

This is not only effective in warming the feet and hands, but

imparts a warmth of a peculiarly agreeable and satisfactory character. Patients coming to the office in the winter-time, and who arrive in a cold state, often speak of the gratifying sensation of comfortable warmth which quickly pervades the system during treatment. Under ordinary circumstances it is not usual to administer sparks to the soles of the feet, but I am in the habit of doing this always when the feet are cold, and the effects of the application are always appreciated. They are a sovereign remedy.

Habitual Subnormal Temperature.—Many neurotic, neurasthenic and anæmic states present temperatures from one-half to one and one-half degrees below the normal. Positive static electrification applied for about fifteen minutes raises this temperature to normal. The patient then experiences a sense of well-being and of improved health. When the electrification is repeated daily, or every second day, for a short time, the temperature remains normal and the general improvement in health becomes established. Local applications to the spine will hasten the improvement.

The static current is a mild but very efficient regulator of abnormal function. Heart action, respiration, pulse and temperature are all adjusted by it to proper action when the derangement is functional only. Even in organic disease it tries to do the same thing and helps materially. It is therefore a valuable auxiliary aid to treatment in various pathological lesions which it cannot directly treat.

To Abort an Incipient Cold.—The strong tendency of static electrification to restore to normal the functional processes is most strikingly displayed within the nervous, circulatory and muscular systems. I have often observed its efficient action in the first stage of a "cold," and the following case is but one of many. It is only selected because it is fresh in mind as these pages are being written.

Miss —— complained one morning of having caught cold the night before; had been awake all night; complete ano-

rexia, nausea, headache, creeping chills, gooseflesh, extremities cold, head hot and general prostration.

Placed her upon the static platform, positively insulated, negative pole grounded. After five minutes of this positive electrification her symptoms ceased. Head became comfortable, hands and feet warm, nausea absent. Closed *séance* in fifteen minutes to attend to other cases, with the result that symptoms soon reappeared, though with lessened severity.

Two hours later she was again subjected to same positive electrification maintained for *thirty* minutes after all symptoms ceased. She spontaneously declared that she then felt as well as ever, and has since remained so.

There are two lessons enforced by my experiences of this kind with static electricity in acute disturbances: one is, that when no invasion of febrile disease is taking place, positive electrification or some static adaptation to the case will direct again the functions into a normal state; second, that the usual short *séance* is ineffective, and that two or more long sittings repeated on the same day will sometimes abort a condition that would otherwise prove tedious and annoying.

Aconite, phenacetin, quinine and other drugs are prescribed with confidence for these patients, but often fail. My own confidence in static electrification has been the result of actual experience, and if it is possible to give the patient the benefit of both current and medication, the liability of disappointment is reduced to a minimum.

Acute Fluent Coryza.—Seat the patient upon the platform connected with the negative pole. Ground the positive pole and also connect it with the breeze electrode adjusted at a comfortable distance above the frontal region. Maintain the plates in moderate action, or sufficiently fast to produce a vigorous but agreeable breeze. Repeat several times as may be needed.

The serous discharge from the nose will usually stop in a few moments, but the patient should continue the application for at least twenty minutes. If the after-conditions are favorable to prevent a repetition of the cold from exposure after the treatment one administration is a well-nigh infallible cure, as I have

observed for a number of years in my personal experience and as it was stated to be by the electricians of the last century.

Sprains and Contusions, Acute and Chronic.—If the static application can be applied immediately, the repair of the tissues, in even very severe cases, will be greatly hastened. Insulate the patient with the negative pole, ground the positive pole and the brass point electrode, Sweep the point gently over the uncovered skin of the injured part at a distance of a few inches so as to give a strong spray. This will instantly remove the sense of heat, pain and tension ; it will reduce the swelling and produce comfort at once.

I have had no opportunity to judge what the full capabilities of this treatment would be if it could be repeated often enough to maintain the good effects. Unquestionably, however, no other means in the hands of the surgeon can approach the static breeze in the kind and quality of work it does in these cases.

If the patient goes home and does not have more than the first treatment with static electricity the subsequent management of the case upon ordinary surgical principles will be greatly facilitated even by the single treatment. If she return from time to time the reparative processes of nature can be advanced, and subsequent stiffness of the joint removed, more satisfactorily by electricity than by other means.

The ordinary mild form of sprain (as from turning an ankle in walking) is at once relieved by rapidly interrupted faradic sedation followed by a few slow contractions. Place the positive electrode on the site of pain and pour in the current until all pain and contusion is removed. In a more severe case repeat p. r. n.

Hypostatic Cutaneous Congestion, Dropsies and Local Œdemas.—Restore tonicity to the tissues by the general application of a high-tension induction coil current over the affected parts.

If a lower limb is affected, select two similar sponge-covered hand electrodes, moisten them in hot water and lubricate by

rubbing them a few times over a cake of toilet soap. Switch into circuit the 800 yard No. 32 secondary coil, the rapid vibrator and three or four cells. With both electrodes in contact upon opposite sides of the œdematous tissues increase the current strength through the rheostat from zero until it produces decided sensation and a firm grasp upon the muscular fibres. Keeping the electrodes a few inches apart promenade them over the limb, avoiding any tender bony prominences. Begin at the foot and gradually work toward the hip. Continue the application for about ten minutes.

If induration is present in chronic joint swellings, varicose conditions, etc., the softening effects of negative galvanic electrolysis should first be obtained. The same electrodes may be employed. Moisten them in a one or two per cent. solution of bicarbonate of soda, connect them with the opposite poles of the galvanic battery and place the negative upon the affected part with the positive opposite. Pass a constant galvanic current of from 15 to 25 mil. for about twelve minutes. Then reduce to zero. Switch the interrupter into action, increase the current until contractions are caused, and after about three minutes close the sitting. Repeat three or four times a week until improvement ceases.

If general tonic and nutritional treatment is indicated the physician who has only a faradic battery may employ general faradization, but the fortunate possessor of a static machine can supplement the local applications of the coil current by general treatment with static electricity in about five minutes' time without disrobing.

Seat the patient on the static platform connected with the negative pole. Ground the positive pole and the brass ball electrode. Start the machine into moderate action and administer mild nutritional sparks to the spine and general surface of the body.

Ascites.—*Galvanic.*—The patient, a little boy, was treated by thirty-nine applications of the galvanic current. The posi-

tive pole was a large abdominal electrode, and the negative a large electrode which was applied alternately to the shoulders and back every other day for fifteen minutes. The tolerance of the patient was from 50 to 75 mil. At the end of three weeks it was evident that the fluid was being absorbed and in a month or two it entirely disappeared, and since then the patient has continued well except for a mild attack of rheumatism. Previous to resorting to electricity all the usual remedial measures had been tried and had failed. (*Walker.*)

Exudation, Infiltration and Localized Œdemas. — When these are situated superficially, and do not present the induration which calls for negative galvanic electrolysis, static electricity may be applied as a spark or as a Leyden-jar current.

First and simplest is the spark application. Insulate the patient negatively and ground the positive pole. Also ground the brass ball electrode to the gas fixture.

If the state is recent, circumscribed and soft, apply but a few mild sparks at a time. If there is a possibility of setting up an active inflammation when a low grade of inflammation is present, use a positive and sedative spray until irritation ceases and then proceed with the spark.

If the condition is old, sluggish and insensitive, and vigorous stimulation is indicated, apply long, thick, powerful sparks in abundance. If the part aches, feels heavy, numb and cold, these symptoms will be quickly relieved and reabsorption of the infiltrated fluids will be rapidly brought about by strong sparks.

There is sometimes an advantage in using the rapidly interrupted Leyden-jar current as a vasomotor constrictor for the absorption of exudations, and it possesses the very great advantage of being more agreeable than sparks, and if the dose is regulated properly it is not only free from the danger of lighting up a slumbering inflammation, but it can be made extremely sedative to congested and inflamed tissues.

The principle of application involves simply placing a moistened sponge or felt covered electrode upon each side of the part and passing through the tissues a current interrupted

with extreme rapidity, and of a strength which is agreeably borne.

If a considerable part of a lower extremity is affected, a larger electrode connected with the positive pole may be placed under the sacrum or on the anterior part of the thigh, while the negative electrode is promenaded in the course of the blood-vessels of the œdematous tissues.

Treatment by either form of application should afford positive relief at each sitting and be repeated every second or third day until benefit is established and further improvement ceases. If the case is very recent, and will require but a few applications, they should be made daily.

Chronic Varicose Conditions of the Lower Extremities.—In these old cases there is often enlargement of the leg, severe aching and pain, and inability to wear a shoe or to walk, except with difficulty and for short distances. I do not refer to simple varicose veins, but to states of long-standing, chronic congestion and rheumatic symptoms associated with the varicosis.

An elastic stocking has many drawbacks, and is an exceedingly poor excuse in the way of treatment. Static sparks are far better, and possess remarkable value in affording symptomatic relief when the anatomical integrity is irreparable. Relief from the sense of heaviness, aching and pain, and the ability to wear a shoe and to walk with comfort, is frequently all these patients require to make them grateful, and static electricity will afford them this relief as certainly as anything in medicine.

Seat the patient upon the static platform connected with the positive pole, ground the negative pole and ground the brass ball electrode. Revolve the machine rapidly enough to produce a strong current, as the tissues are generally insensitive to sparks, and not only do not benefit from mild applications, but the patient enjoys a rather agreeable sensation from powerful sparks, such as are required to relieve.

Apply long single sparks at the rate of about sixty per min-

ute over the entire affected part except the "shin bone," which is too sensitive to endure such an application. If the ankle is œdematous, sparks will reduce the infiltration and increase the mobility of the joint. Only a very moderate decrease in the size of the leg may take place, but all pains and aches will be removed, the sense of great weight will be superseded by a feeling of buoyancy, shoes which pinched before can be worn with comfort, the walking ability and endurance will be restored, and the condition will cease to cripple the patient.

These effects are produced at each *séance* in less than five minutes' time. For the general improvement of the patient I am accustomed then to change the platform connection to the negative pole and apply mild positive sparks to the other leg, to both thighs and to the spine, so that the patient leaves the office "feeling as good as new."

When treatment is first begun the sittings should be daily until painful symptoms are removed, and then three times a week for a couple of weeks longer. If relapses occur during the years to come, a short course of treatment may be repeated at any time, and the patient can thus maintain the comfort of a practical cure even though the appearance of the leg may not have improved to the same extent as the symptomatic relief.

Phlebitis.—Moisten in hot water a flat, sponge-covered electrode about the size of the palm of the hand, and for convenience, if the patient is recumbent in bed, place it under the sacrum where the weight of the body will keep it in firm contact. Connect this electrode with the negative pole of the high-tension induction coil apparatus. Moisten a medium-sized sponge-covered hand electrode, lubricate it by rubbing it several times over a cake of toilet soap and connect it with the positive pole.

Switch into circuit the three secondary coils combining 500 yards of No. 36 wire with 800 yards of No. 32 wire. Adjust the rapid vibrator to a very fast and smooth action and employ three or four cells.

Place the hand electrode upon the anterior surface of the

thigh and gradually increase the current through the rheostat from zero until it causes a perceptible and agreeable sedative action upon the tissues. After regulating the dose promenade the positive electrode over the entire limb from the hip down, avoiding the sensitive parts of bony prominences about the joints and situations which do not require treatment. Repeat twice a day during acute stage and lengthen the intervals as improvement progresses.

Attention to the usual methods of treatment, action of bowels, etc., is of course understood. The effect of the faradic sedation is both palliative and curative.

Obesity.—I am asked so frequently about the possibilities of reducing fat by electricity that it is proper to mention the subject here.

In the case of women who have been depositing fat while menstruating either scantily or not at all, the restoration of normal functions by proper uterine treatment (as described in the part of this work devoted to gynecology) will often arrest the accession of fat and greatly reduce the deposit.

In other cases, either women or men, in which the state is a fatty debility which nutritional improvement will correct we may employ static electricity with advantage. A French writer reports five cases of obesity treated by him daily or three times a week. The results were excellent. The symptoms of debility disappeared in every case and so did the abnormal stoutness. The method to employ is described sufficiently by the term nutritional. It should embrace not only general positive electrification but combine the reflex stimulus of frictional counter-irritation with the muscle-contracting action of powerful percussive sparks.

In cases in which obesity has been a gradual and long chronic condition in persons who appear to be in ordinary health we should expect but little results from electrical treatment, or if employed it would require a long period of time to determine any decided benefit.

Hiccough.—Obstinate hiccough occasionally calls for extra-

ordinary measures. The natural and instinctive tendency of the medical mind after all other methods fail and the patient is about moribund is to turn to electricity for miraculous help. There is no reason why any electric current applied to the outside of the chest should be expected to control an unyielding hiccough, for spasmodic diseases of all kinds offer a very poor field for electricity. Moreover the cause of the hiccough may be entirely beyond the reach of electric current action. In mild cases however the hiccoughs have ceased when some form of electricity has been employed, while in obstinate cases which have lasted for days and even weeks the patient has had no relief and has died.

Galvanic and faradic currents have been tried in about every way that is possible. A usual method is as follows:

Moisten a sponge-covered, flat electrode, about two inches in diameter, connect it with the positive pole of an induction coil apparatus. Seat the patient in the upright position with the chest exposed. Place the positive electrode over the axillary plexus with the arm pressed firmly down against the side. Moisten a sponge-covered hand electrode in hot water, lubricate it with a little soap, connect it with the negative pole and pass it over the intercostal spaces on both sides extending around the trunk. Commence with a mild current from the No. 32 secondary coil rapidly interrupted, increase the current strength until it produces strong contractions. Continue the application long enough to determine whether it will relieve or not. Cases have been reported in which relief followed very quickly, while severe cases have been controlled in twenty to twenty-five minutes. Repeat p. r. n.

The method described for obstinate vomiting may also be tried.

Morphine Habit.—In the treatment of a patient from whom morphine is gradually withdrawn, other measures may receive valuable aid from the sedative-tonic and nutritional actions of both galvanic and static electricity. Symptomatic disturbances of the nervous system, body heat, circulation, etc., are par-

ticularly well controlled and sleep is often aided by the resources of these currents. No description of technique can be given to cover all cases, but the method of central galvanization practically covers the use of this current, while the more various and more effective applications of static electricity will be found described in the chapter upon *special therapeutic effects.*

Chronic Alcoholism, Dipsomania.—Following the withdrawal of alcohol and prescribing the necessary sedative-tonic remedies, the most valuable and practical benefits are to be derived from nutritional and sedative-tonic applications of static electricity. Both the galvanic and faradic currents may be employed, and to give exercise to partially paralyzed muscles, the slowly interrupted faradic current may be used in exactly the same way as in other paralytic conditions. But for the main purpose of general electrification, the time, disrobing and trouble involved in the use of local electrodes practically displaces these currents in favor of the one which is easily and more beneficially administered.

Seat the patient upon the static platform and connect it with the positive pole. Ground the negative pole, and if the first indication is for sedative-tonic treatment, administer potential alternation (see therapeutic methods for directions) for about fifteen minutes. If mild positive sparks to the muscles of the limbs and general surface of the body are added to this, with especial attention to the lumbar and cervical spine, the patient will derive great benefit from the sitting, Both the physical and nervous energies will be refreshed and strengthened. Local applications must conform to the needs of the case, and with ordinary experience the operator will at once see what it is necessary to do.

Repeat once or even twice a day at first, and continue p. r. n. until recovery is established. The difficulties of drug prescribing and the tendency on the part of the patient to relapse will be lessened by supporting other treatment with static electricity.

To Eliminate Metallic Poisons by an Electrolytic Bath.—*Lead Poison.*—Immerse the lower part of the body in any convenient wooden tub of warm water. Add enough sulphuric acid to slightly acidulate the water. Connect a large copper plate electrode with the negative pole of the galvanic battery and place it at the foot of the tub in the water.

Immerse the hand in a second and separate water-bath electrode. Fill a basin two-thirds full of warm water and add a teaspoonful of bicarbonate of soda. Connect it with the positive pole in the same way that the negative pole is connected with the water in the tub. With the hands and body now separately immersed in the circuit increase the constant galvanic current from zero up to comfortable tolerance of the skin and maintain the action for 15 or 20 minutes. Gradually reduce to zero and close the sitting. Repeat daily or every second day until relieved.

Other Metals.—For metals other than lead substitute nitric acid instead of sulphuric and proceed in the same manner.

To Produce Local Anæsthesia by Cataphoresis.—Cleanse the skin over the part with alcohol, or hot water and soap, to remove oily resistance to the current. Saturate a felt-covered, flat electrode of any medium size, 4×4, in the usual hot-water solution of bicarbonate of soda and connect it with the negative pole of the galvanic battery. Apply this electrode upon the most convenient situation within a few inches of the part which requires anæsthesia. Arm the cataphoric positive electrode with a fresh disc of blotting-paper and saturate it with about ten mimimums of eucaine, or cocaine solution, or guaiacocaine, whichever is preferred.

Fig. 437. Reservoir cataphoric electrode.

Press the electrode firmly down over the tissues, connect it with the positive galvanic pole and gradually increase the constant current from zero up to 10 or 15 mil. In about five minutes increase the current to 20 mil. for a couple of minutes only, and reduce again to the point of mild tolerance. The degree of anæsthesia required may take from five to ten minutes to produce. It can be tested by pricking the surface with a pin, and if not quite complete the current may be continued q. s.

This method can be used upon the cervix uteri and upon any part of the surface of the body where an electrode can be placed, but in medical practice it is only an occasional substitute for the simpler hypodermic method. On rare occasions it possesses superiority. In dental work with a cotton-wrapped probe in the cavity it is the best means yet discovered of obtunding pain and permitting painless dentistry.

Toothache.—Seat the patient upon the static platform with connection to the negative prime conductor, Ground the positive pole and the brass point electrode and apply a strong sedative, positive spray to the area of pain upon the side of the face. Apply the same principles as in treating ordinary neuralgia of the face. It would hardly be expected that this would give more than a few hours of relief to the pain of a carious tooth, and it was so stated a hundred years ago by the men who employed it then. I am not a dentist, but when a tooth is decayed so badly that the end of a lead pencil could be inserted in the hole the fact is sufficiently apparent to my eye to leave little doubt in the matter.

Some three years ago a cook in my household had two or three such teeth which gave her a great deal of trouble. She had a natural horror of our dental friends, and could not be induced to have the tooth repaired until it set up such a paroxysm of ache that she at last consented. As she was in too much agony at the moment to endure the thought of going alone, I applied a positive spray to the side of the jaw for about fifteen minutes.

As the pain completely ceased she changed her mind about the dentist and said she would wait until the tooth hurt her again. This did not happen until three months later, when the same process was repeated. She was in my employ for two years, and in this case and others I have found the relief afforded by the static breeze surprisingly permanent in some very badly decayed teeth.

Galvanic.—Saturate a small pledget of cotton in guaiacocaine or a strong solution of simple cocaine or eucaine and insert it into the cavity of the tooth. Moisten a sponge-covered hand electrode with a one per cent. hot-water solution of bicarbonate of soda, connect it with the negative pole of the galvanic battery and have it held by the patient in any convenient place upon the neck. Arm a needle-holder with a platinum needle, connect it with the positive pole and imbed the point in the cotton in the tooth. Very gradually increase the constant galvanic current from absolute zero until it is felt by the patient but is not painful. This at first may be less than one milliampere, but as cataphoric action is carried on for a few moments the sensitiveness decreases and the current may be increased up to several mil. and until complete relief is afforded. Dental electrodes especially for this purpose are now made.

Painless dentistry is a matter of interest to every person who dreads having a tooth filled. By modifications of producing anæsthesia by the cataphoric action of the galvanic current every dentist has a means of obtunding pain, nor is it necessary that the dental pulp should be fully exposed in order to anæsthetize it so completely that operations are without pain. Surrounding soft tissues may also be completely anæsthetized by the same process. No other portion of the mouth is affected except at the point of application of the electrode and there are said to be no after effects. The time required is from five to eight minutes, and a tooth may "be so benumbed as to allow it to be cut to pieces without pain" if it was desired to do so.

Sore and Bruised Gums Following Dental Work. — In

some half-dozen instances patients of mine have happened to come directly to my office for treatment after leaving the dentist. Sometimes the process of filling a number of teeth has produced a general ache. Sometimes one, two, and in one case six teeth have been pulled out, leaving the gums in an intensely painful condition. None of these patients had received any local sedative from the dentist, but were sent home to let time heal the wound.

The positive breeze directed carefully upon the gums has in every case produced a state of comfort, and at the same time tranquillized the entire nervous system. No one who has not personally experienced the relief afforded by this simple application could credit the change it makes. Of course no electrical current which requires the contact of electrodes could help these cases, nor is any anodyne or mouth wash quite comparable to static in its effects.

CHAPTER LXIX.

TONIC EFFECTS IN VARIOUS CONDITIONS.

The crises of acute asthenic diseases. Faradic sedation in acute disease. Acute physical exhaustion. The debility of old age and chronic invalidism. Convalescence from acute exhausting diseases or any low state of health. Value of static electricity as a tonic agent. Chronic effects of shock. Chronic effects of heat prostration. Nervous chill.

The Crises of Acute Asthenic Diseases.—When a patient is too exhausted to rally and the feeble powers of life must be reinforced or flicker out, the well-known, refreshing, tonic, vitalizing and nutritional actions of the galvanic current may bring about a reaction.

Take to the bedside a portable galvanic battery of about 18 cells, a portable meter, two felt-covered electrodes about 5 × 9 and a pair of conducting cords. Saturate both electrodes in hot water containing a teaspoonful of bicarbonate of soda to the quart, press out the surplus water, fold a towel over the rubber back of one electrode and insert it gently under the cervical spine so that the patient will rest comfortably upon it. Connect this electrode with the positive pole of the galvanic battery.

Prepare the other electrode in the same way, place it over the solar plexus and maintain it in contact with moderate pressure. Connect it with the negative pole. Gradually increase the constant galvanic current one cell at a time until the meter registers about 20 mil. or until a sensation of comfortable warmth is created beneath the positive electrode.

If the effect upon the patient is agreeable, sustaining and composing allow the current to act steadily for 30 or 40 minutes, with a reduction of the dose to comfortable tolerance if at any time the skin becomes sensitive. At the end of the sitting reduce the current to zero and remove the electrodes. Dust the skin with toilet powder. Repeat twice or three times at intervals of a few hours until the crisis is passed. Repeat morning and evening for several subsequent days until convalescence is demonstrated. As an adjunct to other measures this remedy possesses the advantage that it interferes with nothing else that can be done for the welfare of the patient and it brings to the aid of the powers of life the action of one of the most effective tonic remedies known to medicine.

In cases of less desperate character the refreshing, nerve sustaining, tonic action of the galvanic current can also be utilized in the same way.

If the physician is accustomed to the use of induction coil currents or can direct the trained nurse, the patient may be greatly benefited during the balance of confinement in bed by some modified form of *general faradization*, especially over the spine and limbs. Even placing a negative electrode against the soles of the feet with the positive electrode under the nape of the neck as the head rests upon the pillow and regulating an induction coil current to sufficient strength to produce a gentle tingling for about ten minutes is followed by a restful and energizing effect.

When convalescence is so far advanced as to enable the patient to drive or take short walks the office administration of static electricity will be more convenient and beneficial than any other resource of electro-therapeutics. The nutritional methods to employ are described in the chapter upon *special therapeutic effects* to which the reader is referred. Under ordinary circumstances a tedious convalescence which is progressing slowly under the usual treatment of tonic may be shortened more than one-half and rapidly brought to a finish

by adding to other measures the priceless advantages of static electricity, employed in the manner which I direct.

Faradic Sedation in Acute Diseases.—In continued fevers the patient becomes worn and restless, in some cases to an extreme degree, and opiates and other hypnotics often fail to afford any relief. Here the practitioner will be put to his wits' end to devise a plan of relief, and it is imperatively demanded that the flagging powers of the system be kept up and the patient tided through.

Even when opiates and other anodynes and hypnotics as chloral, chloroform, ether, etc., seem to afford relief, it is doubtful if they afford any permanent good results, and it is quite possible that the chances of recovery are often abridged through their influence.

The use of faradism here will prove a satisfactory means of resort, usually affording prompt benefit, for a time at least, and there can be little or no danger of any untoward influence from it. Soothed by its power, if the patient does not go off in a quiet sleep for a little while, he will at least derive enough benefit to enable him to rest comfortably for a time, the tired aching sensations in the muscles passing off for a brief season.

We would not think of treating such cases without the aid of electricity, and are confident that the reader, if once acquainted with the result, would avail himself of it to great advantage many times.

In administering it, the negative electrode should be held to the feet while the positive is applied above by the operator. First, let the negative be held to one foot, while the positive electrode is passed a number of times over the entire surface of the corresponding lower extremity, then let the opposite extremity be treated in the same manner. Now the negative should be held against both feet while the trunk and arms are thoroughly stroked with the positive.

It will be found more convenient, where the current does not irritate the operator, to hold the positive sponge in one hand while the patient is stroked with the other—the current thus passing through the arms and chest of the person applying it. The sensation is more grateful than that of a wet sponge. Here, however, it should be recollected that the current, having more tissues to traverse should be stronger than in the first instance, that the patient may derive as much influence.

It will be well to repeat these applications twice a day, morning and evening, until the febrile stage passes off, pro-

vided they are agreeable to the patient. Whenever they fail to afford a sense of relief they had better be suspended. (*Webster.*)

Acute Physical Exhaustion.—The extreme fatigue and physical prostration which results from acute over-work either in household duties, business or sports, may be quickly relieved by either general faradization or by a general static treatment, and the effects entirely removed by two or three repetitions. The static method requires no disrobing of the patient and takes less time. It is also applicable to many cases who would not submit to general faradization in the physician's office. Owing to the large number now learning to ride a bicycle, especially ladies whose muscles have been untrained and who have taken an unusually long ride, it is useful to be able to give them immediate relief when they are attending for treatment of some other lesion. I have done this in a great many cases. Mild positive sparks upon the muscles restore their tonicity.

The Debility of Old Age and Chronic Invalidism.—Cases occur in the experience of every physician in which some restorative influence is needed beyond the resources of drugs, food and rest, to fit the patient who is stricken with disease in advancing years to escape from house confinement, get out of doors and once more resume the ordinary habits of comfortable if not entirely vigorous old age.

Some of the most estimable men and women in both public and private life cease their activities before their time because of imperfect convalescence from sudden and brief illness. In many cases there is no lack of means or desire to procure every aid within the resources of medicine, and I therefore suggest one measure, rarely utilized as it might well be, but not surpassed in its comfort-giving and strengthening properties by any of the tonics of pharmaceutical art. It is within practical reach of many families who would gladly avail themselves of

so simple and effective a means of benefiting the objects of their solicitous affection, if their physicians but brought it to their notice,

I would recommend in all such cases the employment of static electricity as a general nutritional agent—mild and agreeable in its action. At but a moderate cost the family can purchase a six-plate twenty-six-inch Holtz machine and have it set up in the apartment of the invalid, who can then daily enjoy the subtle and far-reaching benefits under the direction of the medical adviser.

Even when the patient is too feeble to rise from bed the couch can be insulated on glass supports, a chain from the prime conductor can be passed under the covers to the patient's hands, and positive electrification administered for fifteen minutes twice a day.

Long before the feeble invalid would be recuperating under ordinary treatment sufficiently to endure a much-needed drive in the sunshine and bracing air, the static machine in his own room could be strengthening muscles without taxing the weak heart, revitalizing the nervous system, and serving as a most admirable substitute for the exercise that cannot yet be taken.

If sleep is deranged the sedative influence of the soothing head breeze or an application to the cervical spine can be invoked at bedtime. If rheumatic, muscular or other pains and symptomatic disturbances occur during convalescence the skilful application of some form of static current will nearly always give general relief.

Whatever building up of the tissues can be done by usual remedies may go on hand-in-hand with the daily use of static electricity and will be promoted by it. The remarkable facility with which this high-potential therapeutic resource may be employed in sustaining and restoring the feeble powers of the aged of either sex is a strange *terra incognita* to the vast majority of physicians. The medical mind, familiar only with

minor faradic therapeutics, or perhaps acquainted in general with the limitations of both faradic and galvanic methods of technique, may well be surprised at the radically different capabilities of the modern Holtz machine.

No case of the kind here considered can be regarded as receiving the fullest benefits of scientific medicine until properly directed static electricity is added to the extra-drug therapeutics of the attending physician.

Nor will the usefulness of this tonic agent end when the patient is again able to take part in the affairs of life, but daily throughout the remaining years vouchsafed to this world it may be employed with continuous satisfaction and benefit. Speaking from personal observation of the good effects of proper methods of static electrification in the infirmities of the aged I cannot too strongly advise the use of so helpful a remedy in assisting to smooth the pathway and comfort and sustain in mind and body the closing scenes of those veteran pilgrims whose stay on earth exceeds the psalmist's limit, often by many years.

Convalescence from Acute Exhausting Diseases or any Low State of Health.—Insulate the patient upon the static platform with direct metallic connection to the positive pole of the Holtz machine. Ground the negative pole. If the patient is still in a very feeble state, give only simple positive electrification for ten or fifteen minutes daily for the first few *séances*.

As soon as discretion permits, add three minutes' breeze to the head and the same to the spine at each sitting, with the brass point electrode in gentle waving motion, and at a distance to make the application most agreeable. Use only a mild non-irritating breeze; and if the clothing of the patient is such as to make the negative breeze unpleasant, stop the machine and change the platform rod to the negative pole and administer the positive breeze of less potential.

Repeat daily until improvement is so far advanced that three

times a week will be sufficient to continue until strength is fully established.

When the early improvement has progressed to the point of willingness on the part of the patient to receive other applications, a few mild sparks at each sitting should be applied to the spine and to the muscles of the limbs. The exercise thus given to the muscles rapidly imparts tonicity and strength. Usual restorative remedies may be given at the same time, and no means neglected to hasten recovery, for electricity never interferes with the action of medication. Among various means at the physician's command to shorten the tedium of a slow convalescence probably no other agent exceeds electricity in value.

In these cases also the author's method of potential alternation (vibratory massage) is one of the most effective tonic administrations. It is advisable to wait a few days before employing it so that the patient may become thoroughly accustomed to the static machine and recognize its benefits.

As long ago as 1777 we find Cavallo recording the belief that "electricity assists the innate endeavor of nature to restore the sound state." To this useful function I shall now devote a few moments' consideration.

If it is the first consideration of therapeutics to prevent disease, it is certainly of almost equal importance to repair its ravages.

It seems to the writer that on too many occasions we are content with relieving pain, reducing temperature, carrying our patients through acute crises, operating brilliantly, or employing chiefly those palliative measures to which the limitations of our science unfortunately often restrict us. The rest we are prone to leave to nature. Indeed it has been well said that the "triumphs of medicine thus far have been in alleviating pain and in the prevention of disease, rather than in the cure of actual and active morbid processes."

But to all classes of cases—the child delayed in resuming its mental and physical training for future work, the son or

daughter about to enter business or society, the business man in enforced detention from his active interests, the workman losing his needed wages, the wife or mother on whom the home depends—to all these alike the period of convalescence, of reconstruction, possesses an enormous material importance.

The sequelæ of acute and short-lived diseases often prove more tedious and disastrous to the patient than the initial invasion. States of anæmia, of deficient innervation, of organic and functional debility, of lessened tissue resistance, are created which unfit the individual for the duties of life, or render undue exertion dangerous, and out of which the slow processes of imperfectly aided nutrition conduct him with faltering and leaden step. Relapses occur which renew and prolong anxiety, and when recovery is complete (?) there may or may not be the fullest possible restoration of anatomical integrity and the processes that maintain sound health.

I need mention no more than the frequently protracted convalescence from typhoid states, from influenza, from pneumonia, from scarlet fever, diphtheria, or dysentery to call to the mind of the observant practitioner an endless procession of illustrative cases.

So, too, in many chronic cachexias, whether the cause is removed or not, "vitalization of tissue is what these patients need." They need fortifying against toxic attack. For obvious reasons the specialist, surgeon and consultant, does not usually concern himself with hygienic and general measures directed to the ultimate removal of the effects of the disease which no longer exists, or of any cause which he has employed his special skill to eliminate. This is the province of the physician, and in a great measure his success in practice will be proportioned to the care with which he finishes up the tonic treatment of his cases.

It is now my intention to pass over the familiar tonic agents, because we all know them, and to speak of one of great value, but as yet too vaguely appreciated in general practice.

It is one of the curious phases of medicine to-day that it often reserves the aid of electricity till all else has failed, till organic lesions have obliterated nerve cells and nerve fibres, both functionally and structurally, and then demands that electricity, to prove its power, shall, in effect, "reconstruct an organized animal tissue from its ashes." I shall not debate the question of whether this medicinal agent can create something out of nothing, life out of local death, for only its opponents seem to expect that; but it is my purpose to refer in brief to one of its humbler yet still valuable properties.

Says a prominent teacher of therapeutics: "One characteristic and almost invariable effect, due to electric stimulation of the peripheral nerves and their end organs, is the improved nutrition of the patient. It is a matter of common observation in a clinic, where the poor are treated by electricity alone, and in a great variety of methods, local and general, that they make a rapid increase in weight and general health, irrespective of the progress which may ensue in the disease for which they are under treatment."

Indeed the latter may be an incurable one, but we can often treat the patient when we cannot successfully treat the disease, and even in such cases the results may be exceedingly gratifying. Phthisis, in its first and second stages, is a case in point.

In a paper read before the Neurological Section of the American Medical Association, another authority states: "It has always seemed to me that the most important thing in the use of electricity in medicine, the fundamental idea upon which all its therapeutics is based, is its nutritional power."

My own experience for several years devoted especially to the uses of medical electricity has afforded me ample proof of the correctness of the above views; and I may say in passing that I value the services of this agent far more for its utility in a thousand practical every-day cases than for its power to partially benefit an advanced stage of some rare or incurable lesion of the central nervous system.

In the widening range of currents now offered to the expert in electro-therapeutics there is an opportunity to select our methods according to our case.

Local applications for specific local purposes are not here referred to by the author, although certain local methods extend their influence into the general nutrition; but of the effects of what is known as general electrification, whether by galvanic, static, sinusoidal, or faradic coil currents, I propose to speak particularly.

They are all valuable tonics. In convalescence they may be considered alterative, tonic, and restorative, capable of doing excellent service unaided by drugs, and more directly in the line of hygienic and climatic influences. If bodies in low states of health are found to be negatively charged, then the positive charge (which is the rule in health) derived from the static machine is in the nature of a change of climate, and in fact is quite often as beneficial.

The pre-eminent place in nutritional effects may be allowed to the constant galvanic current when the "central nervous system" is principally at fault and degenerations have occurred; but when the debility is rather muscular, circulatory, or functional, then my preference is for an interrupted current capable of producing a powerful impression on the peripheral nerve filaments and stirring to their depths the trophic centres.

In September, 1893, I described a new method of administering an interrupted (oscillating) static current, and it is this method, originated by me, which I employ in the large class of cases requiring an energetic re-invigoration of vitality.

Administered without the removal of any of the patient's clothing and involving no tedious technique, I nevertheless regard it as an efficient substitute for the D'Arsonval "high-frequency bath," and for most other forms of general electrification.

If direct muscle massage is indicated the static spark is demonstrably one of the most effective methods of producing

it, and we have but to add its local influence to my general administrations to secure results of a pronounced character. Regarding the muscular contractions produced by the local spark as a gross massage of the tissues, it is considered that in the general vibratory administration of a rapidly alternated potential we subject the constituent particles of the tissues to an insensible molecular massage, the benefits of which are apparent in the vasomotor system, in better circulation, in increased excretion, in better oxidation, better sleep, more cheerfulness, more vital energy—in short, in an increased functional stimulation and in general progressive improvement.

This is just what we want in convalescence from acute prostrating diseases; just what we want also in every case of lessened tissue resistance when restorative measures are indicated and are practicable, even in diseases like diabetes, Bright's, and phthisis.

In chlorotic conditions, amenorrhœa, and derangements of schoolgirls, especially if a legacy from earlier illness which is not outgrown, the nutritional value of electricity is of very great importance.

It is vastly more useful, I repeat, when freely employed, as it should be in these cases, than when reserved for advanced stages of lateral sclerosis and spastic paraplegia.

It is a sovereign tonic in the debility of old age and in the vast range of so-called "female weaknesses" for the same reason that it serves us in convalescence. If individuals in general, of any age, were "finished up" through complete convalescence to the fullest possible restoration of strength by those whose skill was not found wanting in the acuter stages of disease, there would be less prevailing anæmia, less neuralgia, less "nervous prostration," less dysmenorrhœa, less headache, and less poor eyesight in men and women; less hysterics, less dyspepsia, less disappointment in life, less surrender to the invasion of microbes, less catarrh, less phthisis, less insanity, less crime, less suicide.

I am accordingly an earnest advocate of nutritional remedies during convalescence and in every depressed state in which they are admissible. Not second in value to cod-liver oil, the hypophosphites, phosphorus, iron, or arsenic, but a useful adjunct to them all, will be found the administration of some form of medical electricity.

The profound restfulness and comfort produced by vibratory potential alternation elicits many expressions of satisfaction from patients. Employed conjointly with other indicated therapeutic and hygienic measures in debilitated states, I know of no method of electrical treatment preferable to it in many cases. In either acute exhaustion, fatigue from worry and work, brain and eye fag, or more chronic conditions of debility, neurasthenia and anæmia, it is extremely useful.

Chronic Effects of Shock.—Sudden fright, narrow escape from fatal injury, business calamity, and other causes not infrequently produce a condition of shock which long leaves the nervous system unstrung and in a state of asthenia.

In these cases the sedative-tonic and restorative influence of static electricity does for the patient what no other agent known to the author can so well effect. It is the remedy *par excellence* for morbid fears, debility of the sympathetics, hypochondriacal, melancholic, brooding and deranged states, from above causes.

If anæmia, constipation, and indigestion coexist prescribe the remedies indicated, but the outdoor diversions which would benefit these patients are often reluctantly regarded and the tendency is to neglect them. The chief coercion upon the shattered nervous system must be exercised by some means independent of the person's will.

One of the best agents for this purpose is static electricity. It seizes hold upon the nervous forces, occupies them, diverts them, engages their whole attention, and by mild and gentle compulsion directs them into natural channels of action and restores their natural strength.

Seat the patient comfortably on the static platform connected with the positive pole. Ground the negative pole and administer simple positive electrification for fifteen minutes at the first sitting. After a few treatments in every case, and at the very beginning with others who feel no undue timidity, a positive head and spinal breeze may be added to the simple electrification.

When improvement has well advanced so that the nervous startings have been outgrown and composure and endurance have somewhat returned, the principal muscles of the body may be exercised by mild sparks.

As soon as these can be given with agreeable toleration by the patient the improvement is more rapid, and general nutritional and restorative processes soon terminate the need for further treatment.

The headaches and insomnia which trouble most of these cases are among the first symptoms of the condition to disappear. The treatment should be repeated daily at first and follow the usual rule as benefit progresses.

These unfortunates, whether men or women, are frequently left to time to outgrow their infirmity, and it takes a long time to do it. They are not considered invalids and they encourage themselves in the belief that they do not need any medicine, but they are more or less unfitted for their regular duties, and their enjoyment of life is considerably diminished.

With a knowledge of the good effects of static electrification no physician is justified in neglecting to give any case of this kind the benefit of so valuable a therapeutic measure.

Chronic Effects of Heat Prostration.—As the victims of sunstroke or heat prostration survive with morbid susceptibility to future heat exposure, and are often for many years afflicted with neuroses traceable to this cause, it is gratifying to know that the electro-therapeutist can do much to palliate or even remove the condition.

Positive static electrification for fifteen minutes about four

times a week for a period of two or three months will do much to restore the system to endure the heat of the following summer.

Supplementary methods for sedative-tonic effects should be selected and applied, according to the judgment of the physician, in the management of the particular case. The head and spinal breeze and mild spark will be useful in many cases, but no routine method can be pursued.

Personal experience illustrates the value of static electricity as a restorative after the acute stage. One patient of mine who could not venture into her own kitchen four years after her attack without suffering, made good improvement under positive electrification supplemented by the spinal breeze.

For the headache which is usually a feature of these cases, and also for the mental asthenia, administer a positive head breeze, regulated in strength to comfortable tolerance, for several minutes at the close of each *séance*. When applied by means of the stationary electrode request the patient to gently move the head from side to side and rotate it slowly so as to direct the breeze upon every portion of the cranium.

Nervous Chill.—Chills from exposure to cold and even the chill of ague have all been aborted or speedily ended by me by the application of static sparks.

The regulating tendency of static electricity upon the circulation and temperature of the body is very marked, and is always one of the first things that attracts the attention of patients coming to the office in cold winter weather and in a state which they declare to be "half-frozen."

It accomplishes the warming process in a manner which seems peculiarly to gratify these patients, and which differs very much from the effects of a stove, hot-water bag, a hot drink, or a stimulant. It in fact does not act as a stimulant or as external heat but as a regulator of the internal functions to normal.

Ground the negative pole and the brass point electrode to the

gas fixture. Connect the patient with the positive pole of the Holtz machine. Start the plates into medium action, which, if the power is an electric motor, will soon increase in speed as the resistance of the circuit diminishes. Commencing at the spine, apply a strong, warming rubefacient spray up and down the back, across the abdomen, and over the lower extremities until the body is in an agreeable glow. Discharge occasional sparks from the electrode by sweeping it nearer the person.

If the patient is accustomed to the treatment and not afraid of sparks exchange the point for the brass ball electrode, reverse the polarity of the platform, and apply a few single thick and long sparks to the soles of the feet through the shoes, to the muscles of the legs, and to the spine.

The warmth that follows this vigorous application is curative of the chill, unless the cause is the invasion of an inflammatory disease, in which case, of course, the failure of the current to produce any but temporary effects is at once diagnostic and medical measures are indicated. There is no reaction, however, in the class of cases to which static electricity gives practical curative relief and the method is remarkably satisfactory.

CHAPTER LXX.

APPENDICITIS, MENINGITIS AND TETANUS.

Special clinical cases.

Appendicitis.—*Clinical Case.*—Miss F. T——. Aged 20: highly cultured and accomplished; delicate organization and nervous temperament; habitual constipation.

On the 14th of last March began suffering from severe pain in the abdomen, elevated temperature and occasional vomiting; bowels costive. She continued to grow worse for three days under the domestic remedies used by the family. When called to see her on the 17th the features were pinched, there was decided tumefaction, swelling and tenderness in the region of the McBurney point; there was irritability of the stomach and complete anorexia with dry surface and a temperature of 102.

On a direct line from the superior crest of the ilium to the umbilicus about midway was a well-defined tumor easily outlined with the finger tips and as large as a small orange. Moderate pressure gave much pain, the area of tenderness extending some inches beyond and around the tumor. To unload the portal circulation and secure a thorough evacuation of the bowels I gave small doses of the mild chloride of mercury and ordered a saturated solution of salts and glycerine enema to be given in twelve hours. Hot stupes were ordered to be constantly applied day and night. To relieve nausea and quiet pain ordered creosote, salicylate-bismuth, chloroform water and codeine.

The pain being constant this was continued for several days. All food was proscribed except iced buttermilk. To induce sleep, trional in fifteen, thirty and finally sixty grain doses by enema at night was given with very satisfactory results.

The bowels responded well to the calomel and the enema with copious actions, but no improvement followed. The peritoneal tenderness continued to extend in a downward direction until it reached Poupart's ligament on the affected side, involving the uterine adnexa and bringing on a premature menstrual flow.

The hot stupes and other treatment, omitting the mercury, was continued until the 20th without any improvement.

Notwithstanding daily movements from the bowels there was no reduction in the size of the tumor, showing that it was not of a stercoraceous nature, The stomach now began to rebel against all medication, and I realized, much to my chagrin, that I was soon to lose it as a medium for further medication and would be driven to hypodermics.

Encouraged however by an experience with faradic electricity in a former case of appendicitis and having just procured an improved high-tension induction coil apparatus I determined to avail myself of whatever good I could secure from it.

A large electrode well moistened with warm water was laid over the entire area of abdominal tenderness and connected with the positive pole. A negative electrode 10 × 12 inches was placed under the buttocks. The 1,500 yard No. 36 coil was switched into circuit. The interruptions were the most rapid that could be obtained from the apparatus and the current strength was made just barely perceptible to the patient. I personally supervised the first application, which lasted one hour, and ordered it repeated one hour in every four. Some degree of comfort was experienced from the first application and no persuasion was needed to induce her to continue them. The hot stupes were ordered continued in the interval between the applications of the current, but as they had been all along attended with discomfort (the patient declaring that the nausea was aggravated by their use) I gave my permission to stop them.

Within twelve hours the anodyne and sedative effects of the current became so manifest that the young lady begged me to stop all treatment but the battery, and insisted that her stomach would not tolerate any more medicine. I granted her request and no medicines were given and no local applications were made other than the induction coil current until convalescence was established.

The *séances* were continued one hour in every four from early morning until 10 P. M. and for the first few nights between 10 P. M. and 6 A. M. The applications were made uninterruptedly until April 4th, with slow but gradual improvement, when I pronounced her convalescent. The temperature remained elevated one or two degrees during the entire time and the outlines of the tumor could be clearly made out with the eye. The temperature was now normal, the nausea gone, the tongue moist, the tenderness had disappeared, and the cold feet from which she had suffered all along (requiring hot dry applications) grew warm. The bowels, heretofore requiring an enemata of salts and glycerine every other day, responded naturally.

It now occurred to me that by continuing the treatment and using a more stimulating current to subdue the subacute condition left by the acute attack, which in my opinion may explain the liability to recurrence, I might protect my patient against a recurrence. The applications were continued using the 800 yard No. 32 secondary coil for thirty minutes—at first three times a day, then twice a day, reducing the size of the electrodes and gradually increasing the strength of the current. Caution is necessary in the regulation of the dose to avoid overstimulation. When any warning of this occurs simply reduce the current strength and return to the sedative dose for the time being. The applications were continued in this case until the 13th, when all treatment was suspended. The young lady at this writing is in the enjoyment of her usual health.

Two years ago I was called in consultation to see a similar case which had continued to grow steadily worse for five days under the ordinary treatment of the attending physician. The pain in this case could not be controlled with hypodermics of morphine pushed almost to narcotism. I advised the use of the induction coil current with decided improvement in thirty-six hours and recovery in six or eight days. Within twelve hours half the quantity of morphine before given without effect gave the patient comfort and the quantity was daily reduced and soon withdrawn. There has been no recurrence in this case.

The coil current antagonizes no other medication, is easy of administration, far-reaching in its effects, possessing an interpolar action supremely above the ordinary topical applications (blisters, poultices and stupes), which only act as revulsants and modify engorgement of the deeper structures by but a small degree; faradic sedation is a valuable adjunct to the medical treatment of appendicitis. (*Williams.*)

Cerebral Meningitis.—*Traumatic.* In 1891, S. R., 32, brakeman, was admitted to hospital on account of chronic cerebral meningitis which had resulted from a lateral crush of head between cars three months before. He had been in another hospital during that period, and said that he had not had a half-hour's continuous sleep during all that time, though he had taken frequent and large doses of anodynes, etc. Along the sagittal suture and between it and the left parietal eminence there was so much hyperæsthesia that the lightest touch of the finger caused intense pain. I treated him for a few days with various anodynes and had him watched closely, and it became evident that he could not be made to sleep longer than five or ten minutes at a time. I then had his head shaved,

and tried galvanism, placing a large, light electrode over the sensitive part of head and an ordinary sponge electrode in left hand and turned on, by rheostat, a downward current of 2 ma. This was all he could stand, and at times during a *séance* of ten minutes, it became necessary to shift the head electrode. The current caused some immediate relief of pain and tenderness, and besides a feeling of numbness of left arm.

The same treatment was repeated that day, with the same result, except that the relief of pain, etc., of head and the feeling of numbness of left arm lasted rather longer, about two hours, during which time he fell asleep in his chair—the first natural sleep after the accident. On the following day he could tolerate a little stronger current, 3 ma., though the current had to be temporarily reduced to 2 ma., during the *séance*, on account of severe burning sensation. The experience of relief of pain and also the feeling of numbness again followed the treatment and lasted for a long time—three hours, and he again slept after the *séance*. Similar treatment was kept up daily and occasionally twice a day with similar effects. The only modification of application was the shifting, carefully, of the negative pole from one hand to the other during *séance*, and in this way numbness of the left arm was prevented.

The patient steadily improved; the current was gradually increased in strength; the hyperæsthesia and pain became less and less, and the relief after *séance* gradually lasted longer, until in the course of a month he got sufficient sleep—three or four hours regularly after *séance* and some at night—without the use of any medicine. At the end of two months' treatment he was discharged cured and has worked steadily since. (*Woolsey.*)

Spinal Meningitis, from Concussion.—In 1886, J. L. P., 30, brakeman, admitted to hospital on account of concussion of spine from railway collision. After five weeks' general treatment the acute distressing symptoms passed off but left an apparent congestion at the upper dorsal spine where, upon pressure, there was tenderness and pain, and after exercise severe intercostal pains. A current of 3 to 10 ma. was applied —positive electrode moved over tender part of spine and negative electrode fixed at buttocks. During the *séance* of ten minutes, finding that he could not at once stand 10 ma., a weak current was given, and after a minute or so he could tolerate it a little stronger, and before the close of the *séance* could stand 10 ma., providing the electrode over the spine was kept in motion.

This treatment was repeated daily for six days, when the

sensitiveness on pressure and the exaggerated electro-sensibility had greatly diminished. Then, however, the house physician gave the current accidentally in an upward direction with the effect of waking up morbid sensibility of the spine and rendering the patient more nervous and irritable, and that night he was unusually restless. On the following day the regular treatment, descending current, was used, causing immediate relief of tenderness and nervousness, and the patient slept for an hour immediately after the *séance*. This treatment was continued daily except Sundays for two weeks longer, when the patient was discharged. He worked as ticket collector for three years without interruption though suffering at times for a few hours, and occasionally at night, from pain at upper part of back. He was assigned to duty as brakeman, and after a few days of such work was again admitted to hospital, in 1890, with acute spinal meningitis. The dyspnœa on account of intercostal neuralgia, etc., was distressing, and cyanosis was marked, and he complained of pain at the back, neck and head, and also at the extremities. He was kept constantly under the influence of morphia. His wife and brother-in-law—a physician—and the membership of the hospital staff expected his death daily.

This was the condition in which I found him four weeks after his admission. At once I applied a stabile, downward current without disturbing him much in bed, anode about one foot long and three inches wide over the most sensitive part of the spine, the upper dorsal and lower cervical, and cathode at feet. I began with 5 ma. and increased to 12 ma. during a *séance* of ten minutes and the relief was almost instantaneous; and before the *séance* was over patient went to sleep. This treatment was given twice daily for several days, and each time with the effect of causing sleep before the *séance* ended. The patient gradually improved and the number of *séances* was diminished, but the rather strong current was kept up as the patient always asked to have it stronger, and on some occasions, through the offices of an indiscreet fellow-patient, he got as high as 40 ma. and yet with apparent good effect. But after about two weeks' treatment patient began to complain of pain in the left leg and of abnormal sensations at the foot and of a drawing feeling at the toes.

He had now so far recovered that all anodynes had been withdrawn; he was able to sit up in bed; soreness and pain at back and neck had largely abated and his appetite had returned. I continued the treatment daily, except using a weaker current 8 to 10 ma., for a month longer, always with agreeable immediate effects, and the spinal tenderness had

entirely disappeared; and there was but one complaint, that of pains at left leg and foot. He could walk about town and felt himself improving from day to day, but his face began to be a little œdematous. The treatment was continued and there was no indication of return of spinal irritation; but each day there was some new phase of œdema and soon it became quite general and very pronounced, the skin being distended to its utmost, and though patient could yet walk when raised up, he could not arise from his bed unassisted. The heart and urine were examined but no evidence of organic lesion was discovered. I now suspected that the current had caused it, and putting my theory to a further test, gave an ascending current of the same strength—stabile, with anode at feet and cathode at lower part of back, keeping far below the site of original irritation. On some days of treatment a transitory irritating effect was occasioned at the meninges of the upper dorsal portion of the cord, but was always promptly controlled by the temporary application here of the positive pole. After the first day's treatment with the ascending current, the œdema began to subside, and during a ten days' course of such treatment entirely disappeared, and with it the numbness of left leg; and the patient was discharged recovered. He went to work as flagman and continued at such work for several months, but then caught cold and died suddenly of pneumonia. (*Woolsey.*)

Tetanus.—The following case is still alive and well:

M. L., aged forty, butcher, admitted to hospital twelve years ago with tetanus caused by a superficial scalp wound which was foul but readily healed under antiseptic treatment. The opisthotonos was extreme, the trismus was complete and his efforts at inspiration were distressing and accompanied by a shriek. I applied a stabile constant galvanic current, the positive electrode applied to the entire spine supported by a pillow as his body was arched forward, the negative at the feet. The current was maintained for six hours without sensible improvement; was then suspended for one hour, and then reapplied and continued for the night, and on the following morning the patient was better—respiration less shallow, expiration less noisy. There was less trismus, but the mouth could not be opened. The current was withdrawn, but after an hour the convulsions were violent. The current was again applied as before and in less than an hour the symptoms abated slightly and the current was again withdrawn. In a few minutes severe spasm and rigid opisthotonos again returned, but

the application of the current caused some apparent relief in the course of a half-hour.

It now became evident that we had the case under some control and the electrodes were left in place except as they were removed to freshly moisten; when the symptoms were aggravated the current was turned on and when they abated it was turned off. As yet, however, the patient could not move a muscle of his body.

On the third day when under the influence of the current the mouth could be forcibly opened a little, and for the first time he swallowed a little water—a teaspoonful at a time—but did this with great difficulty; but even now when the current was withdrawn for an hour or so, spasms returned and instantly held him so rigidly that no external muscle could have been forcibly relaxed without rupture. (About this time an attempt of a new heroic nurse to bend him resulted in the breaking of the foot of the bedstead.) Gradually the current acted more promptly and had a more relaxing effect and the recurrence of spasms became less frequent. In the course of a week the spasms yielded within a minute after turning on the current, and during intervals of repose patient was fairly comfortable and could take liquid nourishment, but he was too sore to move, as the muscles, abdominal and thoracic, as well as those of extremities, seemed to have been nearly torn from their attachments by the violence and persistence of the spasms.

About this time, on an occasion of recurrence of spasms, I administered the current experimentally in an upward direction, but instead of controlling the spasm it increased its severity, and upon reversing the current to a downward direction the spasm was again abated. From this time on the current was gradually reduced and the time of its administration diminished. At the end of three weeks' treatment the patient was discharged recovered, though his muscles were yet so sore and stiff from previous tension that upon rising from his bed or chair he could scarcely move for some minutes, and he could not turn his head, but the stiffness gradually disappeared, and he is still alive and well.

In this connection it may be of some interest to state that when a current of extraordinary strength, 70 to 100 ma., is delivered to a rabbit in the descending direction, the spine will be arched forward and the head and tail drawn up; and when delivered in the ascending direction, the spine will be arched backward and the head drawn somewhat downward and close to the trunk, and the tail drawn downward and forward; and moreover, that such contortions will follow such

current direction however frequently the current is reversed ; and moreover, that rabbits thus severely shocked by such reversals of such current are likely to die in the course of a few hours with convulsions of a tetanic character. (*Woolsey.*)

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MANUAL of Static Electricity in X-Ray and Therapeutic Uses, by S. H. Monell, M.D., Founder and Chief Instructor of the Brooklyn Post-Graduate School of Clinical Electro-Therapeutics and Roentgen Photography; Fellow of the New York Academy of Medicine.

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The book bristles with fresh and reliable facts, and generally is one which the medical library will scarcely be complete without, especially for the electro-therapeutist and the surgeon, in both hospital and private practice.—*Electrical Review*, New York, June 16, 1897.

The author is one of the most illustrious teachers of electro-therapeutics in America, the founder of a school in this branch of the art of medicine, and the present volume at once becomes a standard work upon the subject treated.

The publishers have done themselves credit in the typography and general make-up of the work.—*Medical Sentinel*, July, 1897.

The medical profession is indebted to Dr. Monell for the first scientific work which has appeared on electro-therapeutics and the X-ray. It is a comprehensive volume of over 600 pages, with several excellent illustrations. The book gives a scientific exposition of the proper methods of applying the different forms of electricity, with special attention to the X-ray apparatus and static methods. Rheumatism and allied diseases, gout and its congeners, neuralgias, functional disorders of the nervous system, pain, brain fag, headaches, sleeplessness, and many other diseases, including those of paralysis, are fully exploited, the moral effect of the static machine as a medical apparatus not being forgotten. Altogether the book is gotten up in first-class style, and is interesting as well as instructive. Medical men and others interested in this form of therapeutics cannot do better than to peruse this excellent work.—*Pacific Medical Journal*, July, 1897.

Manual of Static Electricity in X-Ray and Therapeutic Uses.

By S. H. MONELL, M.D. 670 pages, octavo, cloth.

The portions of this work which treat of X-ray photography will not be amiss, while its discussion of static therapeutics will no doubt be appreciated. Certainly the reader will find within its covers a large amount of information which, so far as our knowledge goes, is not obtainable elsewhere. The book is therefore highly valuable to the practitioner.—*New York Medical Journal.*

This book has a threefold interest, first, because it is the most important book in the English language on Modern Applications of "Statical" Electricity to Therapeutics; secondly, because it supplies reprints, most useful for purposes of reference, of the reports of Addison, Golding-Bird, and Sir William Gull on the subject of statical treatment in the earlier part of this century; and, thirdly, because it draws attention to the advantages of the electrostatic machine for X-ray work.

In England the excitation of X-ray tubes by electrical machines seems to have been tried and abandoned, the probable reason being that good machines are extremely uncommon in this country. Theoretically, an apparatus capable of supplying a steady electromotive force high enough to excite the tubes should present advantages over the intermittent current of the induction coil, and practically it is so. With a good Wimshurst machine there is a brilliant illumination of the phosphorescent screen far superior to the flickering light given by a coil, and time is saved in exposures of photographic plates. Dr. Monell claims to have procured with five minutes' exposure results as good as could have been obtained in half an hour with coils. He writes with confidence and is evidently an experienced worker with the X-rays. A machine with eight 30 in. plates is the size which he finds best, and though his work was done with a Holtz machine (the type most used in the States), the Wimshurst machine is certainly as good and probably is better for the purpose.

Turning now to his account of the therapeutic uses of electrostatic treatment, we find much which is calculated to afford food for thought. In England the statical machine has not yet been seriously taken up, but it is evident that Dr. Monell finds in statical treatment a most valuable agent for the relief of rheumatic and other painful states, such as neuralgia and sciatica; also in neurasthenia and in melancholia and other morbid mental conditions, where he finds it to have a general tonic effect which is productive of good.

The style of the book is spirited and practical; it supplies a want, and should lead to a further study of electrostatic methods in this country.—*The Lancet*, London, Sept. 4, 1897.

To say that Dr. Monell has supplied a long-felt want but feebly expresses the value of the contribution which in this volume he has made to medical literature and to the healing art. Those who are at all familiar with the subject of medical electricity will have no occasion to seek for the *raison d'etre* of this monograph. It is in many respects unique, and comes at the right moment to fill a gap which has long been a reproach to medicine.

It is somewhat remarkable that such a means of treating disease and alleviating pain as the profession has in static electricity should have been so long overlooked by a class of men who, as a rule, are always alert to seize upon everything which will help mankind, but such is the fact. Dr. Monell tells why this is so. It is partially due to the imperfection of apparatus, and partly, and to no small extent, to the ignorance of physicians as to the method of caring for it. As it is well said by the author, "The static machine must be considered on the individual merits of itself and operator, as distinguished from static electricity in the abstract. No cripple is more helpless than such a machine without its electrical charge. It is absolutely useless. It is more aggravating than an inert preparation of ergot or an insoluble cathartic pill. It is like an empty rifle. Without a proper charge the rifle and the Holtz machine are equally inoperative, and both equally require a directing skill in order to achieve results."

Dr. Monell has divided his book into two parts. In Part I. he treats of the Holtz Apparatus and its Care, Therapeutic Methods, Platform Methods in General, How to Regulate the Strength of a Static Application, X-ray Apparatus and Static Methods, Crookes Tubes, X-ray Photography, X-rays in General, Electro-Physiology, and Therapeutics of Static Electricity. In Part II. he discusses Historical Therapeutics, quotes Cavallo on Medical Electricity, and the reports of Golding Bird, Hughes of Guy's Hospital, Sir William Gull, and Dr. Arthius, of Paris.

Dr. Monell's style of writing is easy, clear, and concise. Dr. * * * * of New York, says that it is so forcible and fascinating he could not lay the book down until he had finished it. Although just published, the reception of the book has been such that already a second edition is under way.

At the Seventy-fifth Anniversary Meeting of the Medical Society of Kings, held recently, Dr. Charles Jewett stated that in this society there were twenty-three members who had written thirty-eight books; Dr. Monell's publication makes these figures twenty-four and thirty-nine respectively.—*The Brooklyn Medical Journal.*

Manual of Static Electricity in X-Ray and Therapeutic Uses.

By S. H. Monell, M.D. 670 pages, octavo, cloth.

The need for an authoritative work upon this subject is recognized throughout the medical profession. Such a work is rendered especially necessary by the employment of the static machine in exciting X-rays. This manual covers the medical uses of the Holtz apparatus, and is accordingly a necessity to every physician or surgeon who seeks information on the subject. In the therapeutic chapters the clinical indications for different methods of treatment are set forth with the author's characteristic precision and clearness. Methods of treatment are explained so practically that the reader can understand and employ them. Every statement made by the author is conservative and moderate in tone, and is supported by actual experience. The book presents material for clinical study which is of the very greatest importance to every owner of a static machine.—*The Charlotte Medical Journal.*

This volume is the only exhaustive work so far published on the application and benefits to be derived from static electricity. The writer has gone over the ground admirably well. The adaptation of the X-ray to the Holtz apparatus enhances the value of this method of therapeutics and will encourage a wider field of usefulness.

The author divides the work in two parts, part first being devoted to a careful explanation of the apparatus, care of the Holtz machine, and therapeutics of static electricity. The chapter on pain discloses the exactness of known indications for special methods of treatment. The chapter on morbid mental states is one of the most instructive and valuable in the book. Rheumatoid Arthritis receives especially full consideration, and directions for treatment of every stage are definitely described.

Two entire chapters establish the value of static electricity in the treatment of important skin diseases. These chapters will be found especially valuable to the general practitioner as well as to the dermatologist. The section devoted to the employment of static electricity in gynecology and the various phases of women's diseases states when and how to use this agent with this class of cases. The physiological properties of static electricity constitute the rational basis of its therapeutic uses, and are fully stated.

Five chapters are devoted to Crooke's tubes, X-ray operative methods, and X-ray photography. These chapters are original, and contain complete practical instruction, much of which is not in print elsewhere. The directions are so plainly written out that a beginner can follow them successfully. To those interested in electricity this volume is to be recommended.—*Buffalo Medical Journal.*

Manual of Static Electricity in X-ray and Therapeutic Uses. —By S. H. Monell, M. D., Founder and Chief Instructor of the Brooklyn Post-Graduate School of Clinical Electro-Therapeutics and Roentgen Photography; Fellow of the New York Academy of Medicine, Member of the New York County Medical Society, etc., etc. New York: William Beverley Harison, publisher, 3 and 5 West Eighteenth Street. Pages, 670; octavo; cloth; gilt.

This useful volume is one that every physician and surgeon who is interested in the medical applications of electricity should possess. It is the only work of the kind in the language, and as a pioneer production is remarkably complete in its details and thorough in its descriptions. Dr. Monell is evidently an enthusiast in his faith in the healing virtues of static electricity. The failures of the Holtz machine to give good results he considers due to the bad care or unskillful management of the operator. He thinks that the twin enemies of dust and damp have done more to discredit its results than anything else. A chapter is devoted to collected opinions as to the value of static electricity in medicine, in which citations are made from many authors, both for and against, and then a reconciliation of the conflicting opinions is sought. Directions are given for the care of the Holtz machine, for methods of managing patients when being treated with the current, and for the use of X-ray apparatus therewith. Chapter VII says: "The high potential static current from therapeutic Holtz machines is superior to any coil known to be made at this date (Feb. 24, 1897) in respect to economy, value, efficiency, satisfaction, reliability, and almost all that pertains to the medical and surgical uses of X-rays in hospital and office practice." There is certainly no uncertain sound in such an indorsement. In Chapter XI it is maintained that high efficiency is always desirable in using X-rays, and that "tubes which are too penetrating must as yet be placed in the same category as 'nuggets of gold that are too big.'" The author says that "the rays which cause dermatitis are evidently the old radiant heat-rays discussed by Crookes." He holds that by the use of static electricity with the tubes there is no danger of such accidents occurring. The great body of the work is devoted to the therapeutic uses and value of electric treatment when properly conducted. To one who has neglected the study of this phase of medical science, the great results described, and the multitude of ailments that can be benefited thereby will prove quite a revelation. The closing chapter deals with the claim that mental suggestion is the foundation of electric cures and while acknowledging that this may have some effect, denies that it is the important factor. The author says: "The therapeutic work it will do and repeat, and repeat again with celerity, thoroughness, and unfailing definiteness of action, we cannot succeed in duplicating by any other means at our command. Nor are we aware of any other medicinal agent employed against disease which will accomplish as definite a result in so short a time, and which is so frequently lasting in its effects."

The paper, typography, binding, and mechanical work generally, of the volume, are excellent.—*American Medico-Surgical Bulletin, May 25, 1897.*

MANUAL OF STATIC ELECTRICITY IN X-RAY AND THERAPEUTIC USES. By S. H. Monell, M. D. Brooklyn, N. Y. Published by William Beverley Harison, 5 West Eighteenth Street, New York City.

Of the new books in medicine appearing this year this volume seems to us to be the most useful from a therapeutic standpoint, inasmuch as it deals with a subject but little studied as yet by the profession at large. Dr. Monell has undertaken this work with an idea of furnishing to the active practitioner that knowledge of static electricity which has so far been in the possession of but few who made it a special work. As we advance in therapeutic knowledge it appears that electricity is bound to take a far more reaching position in clinical medicine than at present, and we say this without hesitation because of the advancement already made along this line. The time will come, we fearlessly predict, when the physician who expects to do any business must have in his office all the paraphernalia required to treat any diagnose by electricity. It behooves, therefore, every practitioner to begin early and get an insight to the subject before the latter is so far advanced as to render it impossible for him to overtake the details.

Dr. Monell, whose excellent writings are familiar to the readers of the "Times and Register," begins his book with a description of the Holtz apparatus, following it with a statement of collected opinions as to the value of static electricity in medicine. Chapter III deals with the care of the Holtz machine—a valuable point in any work of this kind. Then follows the therapeutic methods of application in specific details.

Chapter VII contains descriptions of X-ray apparatus and static methods; Chapter VIII, X-ray and Crookes tubes. Then follows the three best methods of operating static tubes with the large Holtz machine, X-ray photography and X-ray effects in general, with electro-physiology and the therapeutic effects of statical electricity.

Chapter XIV begins the consideration of electrical application to the various diseases, rheumatic, nervous and hysterical neuroses, with considerations of special conditions, including gynecological.

Part two is devoted to a historical sketch of the advancement of electricity from the eighteenth century, with numerous accounts of the early Franklin days of electrical experiments, many of which are both instructive and amusing. Then follows various reports from eminent medical gentlemen on the results of static electricity.

We understand from the publisher that there is already a great demand for this book, and we can easily see how this is probable, for the work is one of great value and should stand out prominent as one of the great additions to medical and therapeutical literature of the day.—F. S. P.—*The Times and Register, May 29, 1897.*

Manual of Static Electricity in X-Ray and Therapeutic Uses. By S. H. Monell, M.D. Published by William Beverley Harison, New York. 8vo, 670 pages, cloth. Price, $6.00.

This work will give a new impetus to the use of static electricity. The want of a reliable machine for generating it, together with no good work upon the subject from which needed information could be obtained by the profession, has relegated this valuable agent to an inferior position as a therapeutic means; these two objections are now overcome.

The improved Holtz induction machine is a sure, quick, and reliable source for the generation of static electricity during any kind of weather; and the author of this book has so thoroughly treated the subject that all the information needed by the profession for its use can easily be obtained by perusing its pages. He gives the rules necessary for keeping the machine in good condition. This is a much needed instruction, as the machine readily gets out of order, unless its management is thoroughly understood.

The author then takes up the subject of therapeutic methods and the necessary apparatus with which to make a therapeutic application of this form of electricity. The instruction here given will enable any one to handle a Holtz machine, and to use the electricity generated by it, as a curative agent. Under "Useful Hints," at the close of that chapter, very much instruction is found. At this point, the writer takes up the subject of electro-physiology, or the effect of electricity upon the human body in health. He recognizes the fact that no physician will be able to do as good work with electricity in therapeutic uses without a knowledge of its action upon the system in a healthy state.

This part of the subject is made plain to the reader. The writer has prepared his reader to take up, at this point, the subject of therapeutic uses of static electricity. Each disease that can be treated beneficially by this agent is described separately, and directions for its treatment given. This part of the work is sufficiently exhaustive and instructive to enable any one to use successfully static electricity as a therapeutic agent.

The use of static electricity in the production of the X-rays, and the directions for the use of the fluoroscope, are fully explained. The writer's directions for X-ray photography are plain and easily followed. The use to which the Holtz statical machine has been put in X-ray work has had much to do in bringing static electricity to the attention of the medical profession, and in directing their attention to its value as a therapeutic agent. Those interested in this subject will find a thorough treatise in this work.—J. R. S., *Eclectic Medical Journal.*

Cincinnati, Ohio, July, 1897.

Manual of Static Electricity in X-Ray and Therapeutic Uses.

By S. H. MONELL, M.D. 670 pages, octavo, cloth.

The careful technics given by the author will give new ideas to many who had considered static electricity of little or no therapeutic value.—*The Journal of the American Medical Association.*

This interesting book contains over six hundred pages devoted to the value of the static current. Beginning with a description of the mechanism and *modus operandi* of the instrument, the author treats of the various ways of applying the currents, and gives valuable points for the correction of various errors in the management of the same. An elaborate series of chapters on the treatment of various disorders, such as "neuralgias" and "rheumatism," "hysteria," "headaches," "locomotor ataxia," etc., follow. The subject of X-ray photography is given in an excellent manner. To those desiring information on this branch the author gives his views in a clear and masterly manner. He has had abundant experience here, and the work is to be commended for its treatment of this interesting subject.—*Medical Record.*

This excellent volume is timely and appropriate, inasmuch as it is the first exhaustive work to treat of the static machine as a means of exciting the X-rays. The minute and careful description of the X-ray apparatus and static methods, together with the vast amount of practical clinical suggestions, gives to Monell's work a unique and valuable place in medical literature. We commend it to all practitioners interested in electro-therapeutics and X-ray photography as the best work on the subject up to date.—F. P. N., in *The Medical Fortnightly.*

As new discoveries come, new books must appear. This is the first that we have seen that has attempted to bind up the X-rays. The author aims to present in a concise and intelligent form the essential facts relating to static electricity. This book will be sought after by many. The therapeutical section is quite full and exceptionally good.—*The American Medical Journal.*

The work is truly interesting and instructive. Though we are not qualified sufficiently to judge of the merits of the static current in Roentgen photography, yet we are prepared to accept the author's statements, knowing the marvellous static current as we do. The parts treating of the therapeutics of the static current are as orthodox as need be. Altogether the work commends itself; especially the chapters on X-ray photography. The publishers have just cause to be proud of a work so neat and of such good material.—*The Atlanta Medical and Surgical Journal.*

Manual of Static Electricity in X-Ray and Therapeutic Uses.

By S. H. MONELL, M.D. 670 pages, octavo, cloth.

This volume gives in a very full and elaborate manner the facts relating to static electricity and its application to the treatment of disease. The book should prove a useful one, for static electricity is used to a large extent by some. There is much good matter in it, and it will doubtless prove useful to electric specialists.—*British Medical Journal.*

Owing to the revolutionary influence of Roentgen's wonderful discovery upon the diagnosis of both medical and surgical conditions, every physician should be familiar with the established facts regarding the operation of the improved static machine, which now stands in the front rank of high potential apparatus. This manual practically covers the medical uses of the Holtz apparatus, and is accordingly a necessity to every physician or surgeon who seeks information on the subject.—*The Pacific Record of Medicine and Surgery.*

The author has presented us in this book with a complete résumé of all that is known in regard to static electricity, and more especially its therapeutic applications, a subject about which but little is known compared with the Faradic or Galvanic forms. The thoroughness of the work done may be judged from the extent of pages which the information covers—over six hundred--**and each article gives evidence of being as brief and to the point as is possible with an intelligent presentation.**

The book is largely a therapeutic treatise. There are two parts. In its first, of forty chapters, six chapters are devoted to the Holtz apparatus, its permanency in therapeutics, opinions in regard to it, the care of it, and methods of using it, its therapeutic action, precautions to be observed, how to regulate the strength of a static application, and other hints. Some sixty-four pages are devoted to X-ray methods, a description of the apparatus required and how to use them ; the Holtz appara - tus is considered preferable for surgical and medical X-ray work, its use in diagnosis and medico-legal cases. Chapter ten describes how to work X-rays photography. Then X-ray effects in general are discussed; explanation of the injurious effects sometimes observed. It is explained that dermatitis is almost impossible in X-ray work with the Holtz apparatus and **convective** methods. The therapeutic properties of the X-rays are referred to, and everything relative to this interesting and modern subject is here discussed and made plain.

Chapter twelve is devoted to Electro-Physiology, the actions of static electricity are described, its sedative effects and action on the various functions of the body and power of regulating them ; its want of action in health is pointed out, and its modifying influence on most of the

functions of the body. How it brings about the change is here made clear and the wide range of its action explained, and the modifying influence of concomitant conditions.

The therapeutics of static electricity is very fully dwelt upon, and one is struck with the wide range of morbid conditions in which it is recommended, and with the remarkable results in many instances. He urges a careful attention to the proper care of the apparatus as being a very important point in securing good results. The first group of derangements considered is that of rheumatic diseases, **and here, as in all cases, minute directions are given for all that is to be done—how to seat the patient, where to place the electrodes, when to vary its intensity, length of seance, and the modifications to be observed in the various forms of the disease.** Numerous illustrative cases are interspersed throughout the text. The author regards this method of treatment as one of the most successful in all this class of affections, including rheumatoid arthritis, gonorrhœal rheumatism, chronic gout, and the uric acid diathesis. It increases the elimination of urea and carbonic acid, and reduces in corresponding amount the uric acid in the system by increasing the consumption of oxygen and making metabolic changes more complete. Its great field is shown to be in the various forms of neuralgias and neuritis. It is gratifying to learn that such excellent results as are here indicated can be obtained in such rebellious cases as sciatica, the neurasthenias, chronic chorea, hysteria, and migraine.

The chapter on pain is very instructive, showing the many forms which can be relieved, and its advantages over medical anodynes in incurable forms where it exerts a palliative action.

Chapter twenty-seven shows that static electricity has a wide range of usefulness in skin affections, in combination with other appropriate treatment.

Among other affections in which it is recommended are chronic and subacute inflammatory conditions within the thorax, morbid mental states, chronic cahexias, impaired voice of singers, debility of old age and chronic invalidism, paralytic diseases, etc. The uses of static electricity in gynecology are fully discussed in chapter forty, and it is shown that a variety of abnormal conditions can be relieved by its use. Some 150 pages at the end of the book are devoted to historical therapeutics, showing what has been done in the past with this agent.

The book is one of great interest, and is replete with the information needed by anyone desiring to add this therapeutic agent to his armamentarium. The author might be regarded as over-enthusiastic from the sanguine character of the work throughout, in regard to the wide range of usefulness of static electricity and the wonderful superiority of

Manual of Static Electricity in X-Ray and Therapeutic Uses.

By S. H. Monell, M.D. 670 pages, octavo, cloth.

the Holtz machine; but from such a practical observer and teacher as Dr. Monell one must accept his results as from one qualified to dictate. And if skeptics or others desire to prove the manifold advantages of static electricity in the large range of affections in which it is recommended no better preparation is available than the perusal and study of this excellent and comprehensive work.—*Canada Medical Record, Sept.*, 1897.

This is a timely book on a timely subject. Full directions are given concerning the X-rays, with many illustrative cases showing their usefulness in surgical diagnosis, and their value is considered. Dr. Monell has done wonders with static electricity in obstinate rheumatic conditions; also neuralgias, neurasthenias, etc. This is an exceedingly interesting book, and a necessity to any one interested in this kind of work—and many physicians should be thus interested; such work would add greatly to their practice.—*The Medical World.*

We find in the above volume material that every physician who is interested in the use of static electricity should be in possession of. It is the only exhaustive treatise on static electricity that we are acquainted with, and it deals very exhaustively with the whole subject. The author is careful to explain how static machines should be cared for. He does not wish the blame for failure to be attributed to the wrong cause, and endeavors to place the blame on the careless operator, and the one who does not keep the machine free from dust and damp. We know of no instrument that requires more careful attention than a static machine; but with proper care its action is absolutely certain. Considerable attention been devoted to the production of X-rays by the static machine. Dr. Monell has done most excellent work with the static machine, and his description of the apparatus, and how to use it, is very lucid. The balance of the book is devoted to the therapeutics of static electricity and the examination of clinical results. We know of the good effects of electricity, and particularly of static electricity, and can freely advise a perusal of this most instructive book, and congratulate the author on the clearness of his description and the easy style in which the book is written. The publisher has succeeded in putting out a very attractive volume.—*The Canadian Practitioner.*

This volume is just recently from the press. It is attractively printed in small pica on good heavy paper, is well bound and capable of withstanding severe use.

The general scope of the book is broad and comprehensive, new and

Manual of Static Electricity in X-Ray and Therapeutic Uses.

By S. H. MONELL, M.D. 670 pages, octavo, cloth.

original. The contents are arranged into parts and chapters, the latter into explanatory headlines, full and explicit. The index affords an easy guide to the book's contents.

The work is written in a most attractive style. It is scholarly, vigorous and confident. It picks up the reader, raw and untutored, and conveys to his understanding in convincing language the essentials of static electricity, divested of mask, myth and mystery. It is the only book written in any language exclusively upon the subject of static electricity, and the inventive genius of the author has slipped the cog of time, making the world his debtor.

Two essential features mark the volume: First, its historic interest for purposes of reference of the reports of Addison, Golding-Bird, Sir William Gull, and others, and the "collected opinions as to the value of static electricity in medicine." Secondly, the practical method of using static electricity in all morbid conditions, and also the superior attainment of X-radiance. The book contains about twenty illustrations.

Part I is divided into 40 distinctive chapters, each under entitled captions, the subject matter of which contains all the knowledge known upon the subject, together with the more interesting personal experience of the author.

Part II contains 17 chapters. On page 91 Monell says: "I am not wedded to any hobbies, and at all times approve of the best means which will produce the best results." Again, on page 4: "Electricity is not hostile to any other mode of cure. All that electricity and drugs, massage, and heat and cold and hydropathy, and climate, food, mental therapeutics and surgery combined, can do for suffering humanity is yet utterly inadequate to supply the demand for relief from pain and disease. The united forces of medicine need more help, not less. With this fact in view the author commends the fuller study of static electricity." Again: "The physician instructed in its technique can operate it successfully every day in the year. It is no longer a creature of atmospheric variability." As an example of the charms of style of the author, I quote from page 201, in Rheumatic Stiffness and Partial Paralysis: "Apply the spark slowly for several minutes, with intervals of rest to avoid fatigue. The sense of lightness, buoyancy, endurance, and general well being imparted to heavy, stiff, and inactive limbs by this method is far more appreciable to the patient than the results of any other form of treatment known to medicine."

The book commends itself to every practitioner of medicine, and to every X-ray worker. No person can be informed without this book, for its contents can nowhere else be found.

The American X Ray Journal.

Manual of Static Electricity in X-Ray and Therapeutic Uses.

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Dr. Monell is unquestionably master of his subject. . . . His graphic description of the right and the wrong use of the X-ray meets and combats the erroneous impression that a proper use of the X-ray is injurious. . . . There are several very interesting chapters which will appeal to the general practitioner, of whatever school, namely, those which treat of the various disorders of the body, such as chronic gout and the uric acid diathesis, neuralgias and neuritis, neurasthenia, heart disease, chronic grief and weather neuroses, headaches, diseases of the skin, static electricity in gynæcology, and others of a similar order.—*The American Homeopathist.*

Physicians' Opinions.

In the foregoing extracts from reviews of leading medical journals sufficient reason may be found to warrant the statement that every practising physician or surgeon should possess this useful book. That it is not padded with theory, but is made up largely of clinical and operative instruction which makes it indispensable, is at once apparent to any one who opens the pages and examines any chapter at random. Private letters from many physicians demonstrate that this volume justifies the publishers' confidence in offering it to the medical profession. These letters cannot of course be put in print, but we venture to insert a few extracts showing the trend of unsolicited correspondence.

Dear Doctor :—

Allow me to congratulate you on your Static Manual; *it is the best written medical work that I have ever seen. It is not "padded" with matter one does not want.* .... M.D.

Dear Doctor :—

I recently purchased a copy of your Manual of Static Electricity in X-ray and Therapeutic Uses, and I am so well pleased with it that I would not part with it for double the amount paid for the work unless certain of being able to obtain another copy. . . . Allow me to thank you for the gap you have filled in publishing the work above referred to. ....M.D.

Dear Doctor :—

I was one of those happy men who procured an early copy of your excellent Manual of Static Electricity and must say that I do not see how it was possible to work the static machine with satisfaction before. I want to thank you very much for the great assistance you have been to me through this book. The profession is indebted to you for it. .....M.D.

Manual of Static Electricity in X-Ray and Therapeutic Uses.

By S. H. MONELL, M.D. 670 pages, octavo, cloth.

Dear Doctor Monell :—

I have already gone through your book. Every indication points to an upward interest in X-ray work and electro-therapeutics. If this book of yours could be planted in the office of 20,000 doctors, a revolution would follow in the practice of medicine.

When I see the President of a Medical College and President of a State Board of Health, as superintendent of a large hospital, advise a man in fair physical health to undergo trephining for a 32-calibre missile which had entered the orbit and was supposed to have entered the brain or cranium, and find his patient on the second day in the post mortem room with the revelation that the bullet never entered the head but ranged through the floor of the orbit and lodged beneath the zygomatic arch ; when at the same time, and known to the surgeon, an X-ray apparatus was in town capable of telling the truth without "exploratory surgery"; when this is seen, then I say, the profession should adopt methods in harmony with up-to-date practice and common sense. This book of yours must be an entering wedge. It will win a victory for electro therapeutics and the use of the X-ray. ..... M.D.

Dear Doctor :—

I have read your book from cover to cover—every page. It is convincing.
..... M.D.

Dear Doctor Monell :—

I am now reading your new work on the Static Machine, and am very much pleased with it. ..... M.D.

My Dear Doctor :—

Your book was received promptly on the 1st inst. I assure you that I appreciate it, and must say that the field you cover is one of great extent.

Your exposition of the matter contained is all that could be desired. Certain it is, to my mind, that no physician is doing full justice to his patients or himself who does not, in appropriate cases, give Static Electricity a place in his Armamentarium.

Your book, written as it is in a style so direct and free from technicalities, should be read by every up-to-date medical man. The many indications wherein the advantage of Static Electricity are apparent is simply wonderful. Until your book came to hand my ideas concerning its proper uses were vague, and the indications for it were, to my mind, very limited. Enjoying as I do a fairly large office practice I am pleased to note the results I am obtaining in employing it in a wider field. I have read and re-read your chapters on the X-Ray until I can almost quote the same in their entirety. I made the trip of a thousand miles to see your X-Ray work, and the results I have obtained since my return home have indeed made me enthusiastic. ..... M.D.

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